# creative computing

October 1979
vol 5, no 10
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Graphics Digital Clock for the TRS-80

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*Pages 87-106*

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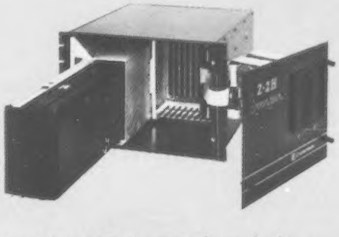

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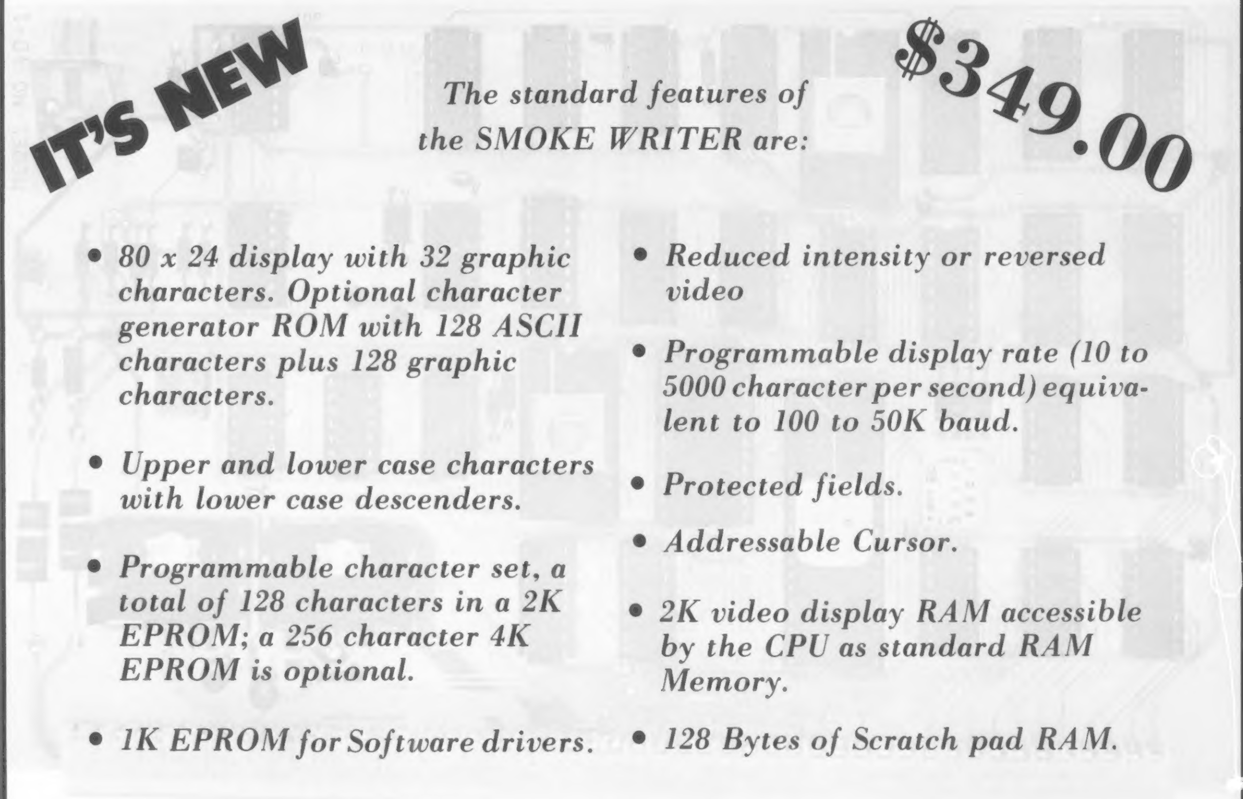

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### The Cover

Our Halloween cover photo was taken by Karen Touhey when a witch dropped in on her to play Adventure. The words on the screen are:

Through the forest you may travel
But first this riddle you must unravel...

The river flows south, the bluebird flies high,
But who is the king that rules the sky?

Stumped? Stay tuned — next month you'll find the complete Basic listing for Adventure in these pages.

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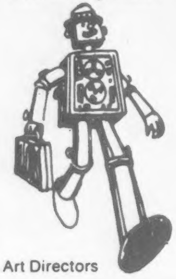

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## Heath, Fairchild and Bally

We have gotten several letters recently inquiring what happened to the Fairchild Channel F system and the Bally Arcade.

**Fairchild**, apparently because of mounting losses in the wristwatch division, has pulled back sharply from consumer products and is no longer marketing Channel F or cartridges for it. We understand that several distributors have fairly large stocks of cartridges. We would expect to see these sold at bargain prices in the near future.

**Schlumberger**, a large French industrial holding company, recently sold the **Heath Company** to **Zenith** and made a cash tender offer for Fairchild. This would further confirm Fairchild's retrenching into the industrial and OEM areas.

Reportedly, Heath is also experiencing financial problems with their kit business except for computers. As a result they have announced intentions to expand into small business computers following the lead of many other microcomputer manufacturers. We can only hope this approach doesn't lead them to total disaster as it did to Processor Technology, Xitan, and several others.

**Bally** is currently marketing the Professional Arcade or Home Computer System, a Basic cartridge and audio cassette interface. Pertaining to the full keyboard unit, a Bally spokesperson would only comment that it will not be available in 1979." Bally normally announces products at the Consumer Electronics Show, so we'll have to wait until the January CES to see what happens.

## A Christmas Challenge

Edward Parker writes to us that the flowchart for checking out unusual sounds and happenings on Christmas Eve (Nov/Dec 1978, page 160) provided the inspiration to write a program, "How To Get Ready for the Night Before Christmas." Ed's program follows the flowchart but has a few additional events. It was written for a 16K Apple II. Ed has also added appropriate music and cartoon-type graphics. The program was a bit lengthy to print in the magazine. More important, we felt that other readers would enjoy writing their own version of the program with enhancements appropriate to children in their own families. Thanks and a tip of the cap for the idea to Edward Parker, 6905 Moyer Avenue, Baltimore, MD 21234.

"I know quite certainly that I myself have no special talent. Curiosity, obsession, and dogged endurance, combined with self-criticism, have brought me to my ideas."

*Albert Einstein*

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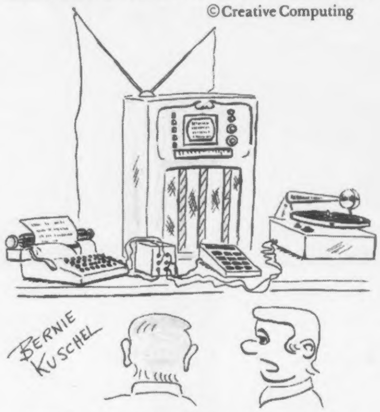

*"Well, it is sort of a budget system."*

## Follow-up on IDSWORD Word Processor

Our review in the May issue indicated that IDSWORD is an excellent word processing system. Unfortunately, we neglected to include the address of the manufacturer. It is:

Interactive Data Systems
P.O. Box 290
Owings Mills, MD 21117

Not only that, but in the IDSWORD ads which appeared in May (pg. 42) and July (pg. 138), the reader service card responses apparently went to the great bit bucket in the sky and not to Irwin Doliner at IDS or to his dealers listed in the ad. So, if you requested information about IDSWORD and didn't receive it, blame us, not IDS.

Still want information? Check out the IDS ad on page 119.

If at first you don't succeed, you're running about average.

## A Typesetting Cipher

Readers of Frederick Chesson's cryptography column in Creative Computing and ROM know that computers are often employed to unscramble codes and ciphers. Here's a stumper on which to try out your skills.

Our Compugraphic typesetting machine uses a series of gears and belts to set line width, justification, spacing, and leading. One day we changed the type face and size while leaving the gear/belt set up for the previous type face. This resulted in the following. Can you decipher it? Hint: It is a portion of the table of contents of a recent issue of Creative. — DHA

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```

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**"SOFTWARE AUTHORS - see separate ad on page 190."**

# Input/ Output

## Lewis Carroll Revisited

Dear Editor:

When I sent you the final version of my Lewis Carroll program, (**Creative Computing**, April 1979) I made the program as long as possible without running out of space on the WANG 2200. As a result of squeezing the program into so small a space, one shortcoming results: after having used the "dump" facility, the user must "read" or "edit" at least once before expecting "is it valid?" or "infer" to work normally. Alternately the user can start the program over, or type "dump" followed by the number 1.

I think it may be helpful to make the following changes which will allow the use of the commands in any order after having used "dump":

1. Move line 120 so that it now reads "885 HO=2" (occurring right after the statement "880 TYPE ONE IN").

2. Insert:

```
2441 PRINT "TYPE A NUMBER BETWEEN 1 AND 28 TO
     LOCATE A DISCONTINUITY"
2442 FOR I=1 TO 28
2443 F(I)=0
2444 NEXT I
2445 FOR I=1 TO 28
2446 IF B(I)=0 THEN 2448
2447 F(B(I))=I
2448 REM
2449 NEXT I
```

The line numbers are in accord with those of the published version in **Creative Computing.**

The program could be lengthened considerably and still fit in a 16K Radio Shack machine, but I fear the second of the above corrections will render the program too big for the Wang. Even so, the first correction will make it possible to use "is it valid?" after a "dump" but having done so it will be necessary to "read," "edit," or "quit - RUN" before using the other features, unless both corrections are entered.

The special problems which these changes rectify should come up rarely and I am quite pleased with the program without them.

Michael Orlove
2058 Powell Ave.
Bronx, NY 10472

* * *

## Borel's Frantic Frenchmen

Dear Editor:

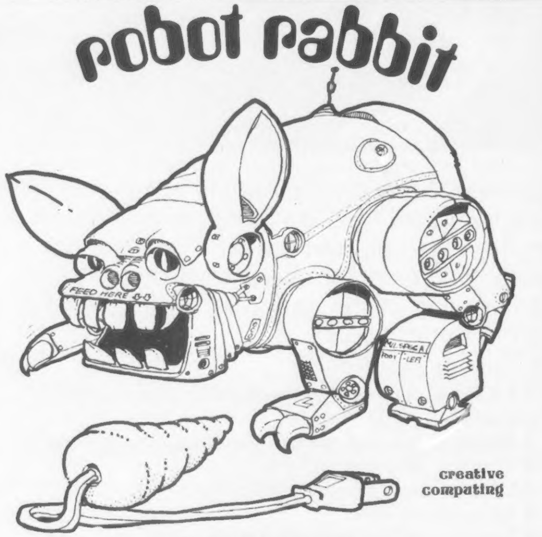
I found your article "Two Million Frantic Frenchmen: A study in probability" (June 1979) by N.B. Winkless, Jr. very interesting. I decided to run the program to the ten year limit on our H.P. 1000 series E mini. However, computation time would have taken approximately six days (24 hours a day). I did shorten the run, and came up with several observations which your readers may be interested in. I ran the program under RTE-IV using HP FORTRAN IV with double precision computation.

Firstly, by using some of the assumptions made by Winkless, I ran into problems. As the ratio X/Y approaches 1, you cannot round the value of P, as P will hit a limit that will never change (on my run, this point was reached after approximately 345 minutes of flipping coins).

We tried running the problem without truncating P and found that using our simulation, there would have been considerably less than 1000 Frenchmen still flipping coins at the end of ten years. Our computing showed that during the thirtieth day the number would go under one thousand. At the end of one year of flipping, the number left equalled 284. Due to variations in machine architecture, I'm sure the results achieved on other machines will differ slightly.

I cannot find any literature about Edmund Borel or his calculations, and can only use my computer runs to prove or disprove his theory. If a reader can inform me if Borel used the product series proposed by Winkless or some other method, I would appreciate hearing from you.

H.R. Hollander
Specialist Engineer
Boeing Aerospace Company
Air Force Plant 77
Hill AFB, Utah 84406



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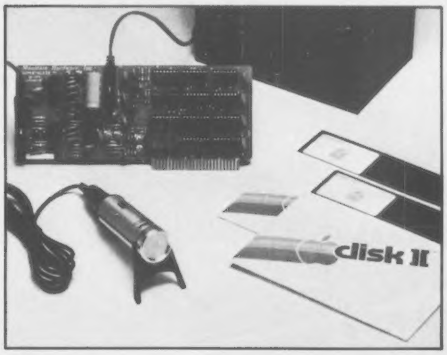

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CIRCLE 160 ON READER SERVICE CARD

## Better Late Than Never?

Dear Editor:

In the May 1979 issue, you published a cribbage game. Looking over the listing, I was struck by the code for shuffling, the deck. I was appalled! Do people still do it this way? It would be particularly critical on a micro. I ran a simulation reshuffling the deck 1,000 times and found that you can execute the two statement loop (at my line numbers 250 and 270) as many as 688 times! With an average of 238 times!

Below is a listing of my deck shuffling routine. It is equivalent to creating a deck of 52 cards in order, then drawing a card at random out of the deck, puting the last card in the hole left by the draw, and then repeating the process for the new deck of 51 cards, etc. This procedure takes exactly 52 tries, no more, no less.

Al Weiss
10529 Oak Dr.
Auburn, CA 95603

*In 1977 we covered the topic of sorting and shuffling extensively and this information is available as a reprint called* **Sorting, Shuffling and File Structures** *(50c postpaid). Obviously, we prefer that the programs we publish incorporate good, efficient programming techniques, but this particular case makes it clear that the idea in using a published program is to improve it, experiment, and to make it the frame work for your own efforts. Blindly typing in code and hoping it works doesn't make sense and you won't learn much. Thanks for your thoughts. — SN*

## On Scouting and Computers

Dear Editor:

Many thanks for your printing of the article regarding Scouting and Computers by Paul Garrison in the July, 1979 issue of Creative Computing. The original merit badge on Computers was highly related to unit record operations and so we managed to modify the requirements in 1970 to the current set. Regretfully I missed the opportunity in 1975 to upgrade the requirements to better reflect the advances in the industry, in particular the growth in "personal computing."

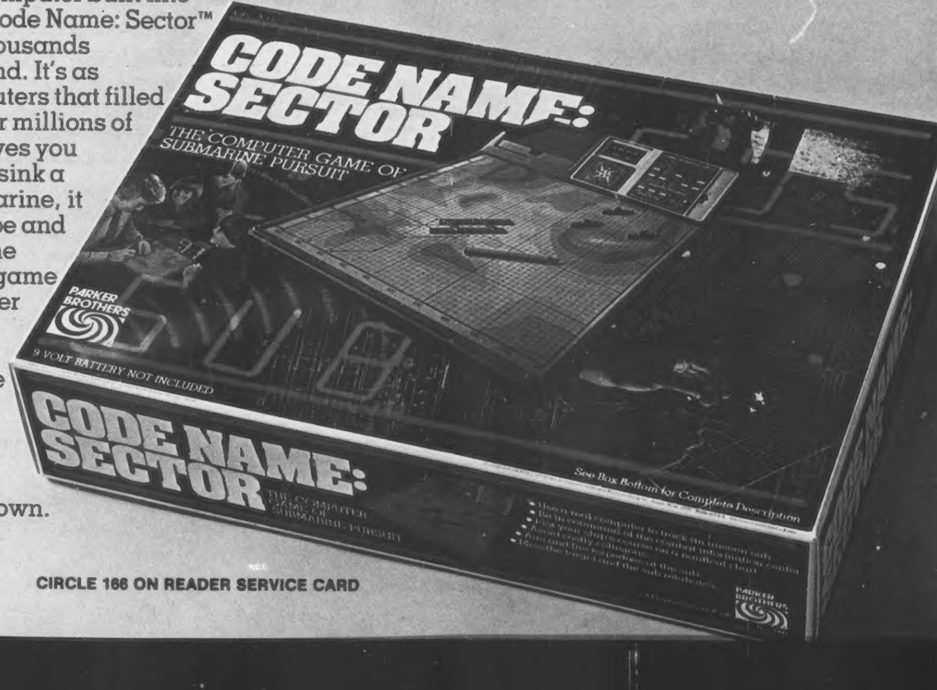
One aspect of Scouting not mentioned in Paul's article is our Explorer program. Throughout the country, members of Explorer Posts have chosen to investigate the Computer field as a potential career. These groups have already graduated many young people into colleges and industry with a very extensive background in our field. As a member of the National Council of the BSA and as the liaison person for the Elementary and Secondary Schools Subcommittee of ACM, I encourage Explorer Posts to **at least** cover the same material as in the merit badge pamphlet and at the same time to obtain a general literacy in Computer Science.

I would be interested in hearing from readers of Creative Computing who are active in Explorer Posts about their program of activities and aspirations. In return I hope to develop a Newsletter for Posts and to give some direction on literacy requirements as established by ACM.

J.A.N. Lee
Professor
Virginia Polytechnic Institute and State University
Dept. of Computer Science
562 McBryde Hall
Blacksburg, VA 24061

CAN YOU OUTSMART OUR COMPUTER?

Don't be too sure. The computer built into Parker Brothers game Code Name: Sector™ is capable of making thousands of calculations per second. It's as powerful as early computers that filled entire rooms and sold for millions of dollars. And, while it gives you clues to track down and sink a hidden electronic submarine, it also helps the sub escape and counter-attack. That's the catch that makes every game a real challenge. Whether you're playing alone or against others, your toughest opponent is the computer. Code Name: Sector™, the electronic board game from Parker Brothers. It's a game with a mind of its own.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THE COMPUTER GAME OF SUBMARINE PURSUIT
PARKER BROTHERS
9 VOLT BATTERY NOT INCLUDED
CODE NAME: SECTOR
THE COMPUTER GAME OF SUBMARINE PURSUIT
See Box Bottom for Complete Description

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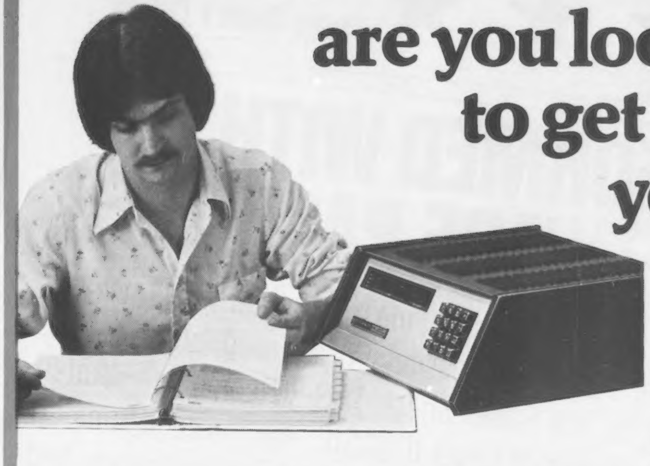
CIRCLE 166 ON READER SERVICE CARD



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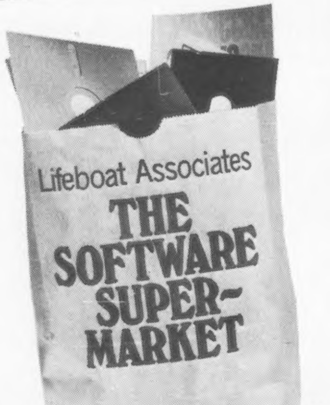

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Software with Manual / Manual Alone

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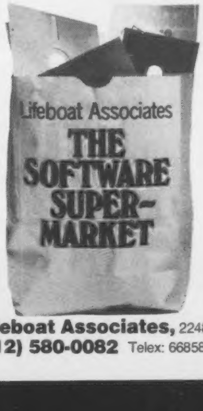

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## I/O, con't...

## Novices: Still Needing Help

Dear Editor:

I am responding to a letter in the March, 1979 issue of Creative Computing. In his letter, Ron M. Salveson explains the dilemma of the novice in the computer industry. I have an Apple II, 32K. I purchased the Apple because I was told it could be programmed in Assembler, I could make use of the disassembler, it has high resolution graphics, 8 ports for peripheral expansion and so on. I got my computer (to use in a small business) and opened the "easy to follow" instructions. When I finished I could write a bouncing ball routine... that's it. I received no instructions as to the use of my high resolution graphics. I can write no programs with it. The company responded to my inquiry and sent me someone else's notes. I didn't understand half of what they sent. In an industry where a half a million units are to be sold there must be someone who can ease the transition from novice to programmer. It seems Apple, Tandy and Commodore would put this info in their phamphlets.

Lawrence V. Ercolino
214 Hillside Drive
Neptune, New Jersey 07753

## Diablo Graphics

Dear Editor:

I read the article "Computer Graphics With The Diablo" published in the June issue with great expectations. Unfortunately, what could have been a fine article and program was reduced greatly in value by two problems.

First, the minor problem. Some Basics will execute a loop at least once even if the initial value of the index exceeds the final value. Not all Basics will do this. For those that do not have an initial index check, logic must be added to the program to prevent one step in X or Y when no steps are desired. A check to see if N9 is zero needs to be inserted immediately after statements 840 and 1030. If this is not done the program will lose track of the print-head position when plotting closely spaced points.

The major problem is that the article spends several paragraphs dealing with a "bug" in the INT function. This reveals that the author does not understand what the INT function is supposed to do. The INT function in almost all Basics returns the as the answer the largest integer less than or equal to the argument. Thus -2 is the CORRECT answer to INT(-1.1). The author's mathematics to get the answer he desires has a major bug. If N9 is exactly equal to -.5 then statements 810 and 840 will make N9 come out to be +1. A positive step will be taken when a negative or no step is desired. The same logic will also turn -.5 into +1 at lines 1000 and 1030. Simply by replacing the logic at both points by

```
N9 = INT (N9 + .5)
```

will suffice to make the program work without the problem the author mentions.

I have tested the program extensively with the loop and half correction logic changed and have had no problems.

The problem may have been caused by failure to check for cases when no step is to be made before entering the loops.

I must find fault not with the author but with your staff. The promulgation of a gross misunderstanding of the working of the INT function does the hobby a great disservice.

Richard M. Belt
98-388 Kaonohi St.
Apt. 4
Alea, Hawaii 96701

## Help With Worthless Software!

Dear Editor:

I am writing this letter out of frustration and anger in the hope that something can be done or at least others can be warned.

I own an Apple Home Computer and I purchase software for it from various sources, such as ads in magazines and at my local dealer.

I have in front of me a pile of worthless software that does not work!! I paid $19.95 for Sargon the chess program and it makes illegal moves. I paid $19.95 for Eric's Talking Disc from Programma and it is really a mess. I paid $14.95 for Dungeon Campaign from Synergistic software and I have a number of examples of bugs in it. This comes to about $55.00 of hard-to-get money paid out for bad programs. Companies that write or distribute this stuff are advertisers in your magazine. Recently World Power Systems Inc. was indicted for mail fraud. They were true crooks and the difference between right and wrong was very clear, but I ask you what is the difference here?

Is there any responsibility on your part that is being neglected, or does each individual have to suffer the chagrin of finding out he has been taken and then fight each long battle at various levels to right the wrong?

This has got to stop and I am in no position to lead the fight but you are if you care.

All the people who have spent 20 bucks and then find out that they have been ripped off don't write letters but they should.

You should listen to them and perhaps start a consumer warning column in your magazine and, last but not least, perhaps if one of these companies were taken to court a legal ruling showing that they are liable for what they do would serve warning that the millions of dollars being bilked from people is illegal and morally wrong.

This is a new industry and it is in trouble and I know that I am not alone in my feelings.

Clarence Greathouse
14422 S.E. 132nd
Renton, Washington 98055

*It's impossible for* Creative Computing *or any other magazine to verify the quality of all its advertisers' products. Further, we're not in a position to assume responsibility for what our advertisers claim although we do try to weed out obvious frauds.*

*You probably have good reason to be disappointed in the quality of personal computer software. The field is still in its infancy. A year or two ago games like Blackjack sold for $20 or more, a case of highway robbery. This year there are still many software companies trying to make it with untested and mediocre programs but a few quality sources seem to be emerging and, fortunately flourishing. Indeed, some of the companies you named market some excellent software. In the future we expect the market to become much more competitive as well as consumers to become more discriminating.*

*To avoid buying worthless software I would suggest trying to see software (at a store or show) first, and/or purchasing only from reputable software vendors. —SN*

*An interesting sidelight to the fraud angle, is that after Creative's exposure of the World Power Systems fraud and mention of two others, two mail order manufacturers have withdrawn their advertising claiming that we made too big an issue of these frauds and thereby cast an undeserved shadow over the mail order industry. Perhaps so. The majority of the industry is quite reputable but we feel strongly that exposure of the frauds and questionable operators will strengthen and not weaken the industry. In this case, I'd rather err in the direction of over-reaction rather than downplaying it.*

*By the way, we're onto one now that may be the biggest case yet. Watch these pages. —DHA*

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CIRCLE 137 ON READER SERVICE CARD

## CRIBBAGE Debugged

Dear Editor:

Several readers have contacted me concerning my CRIBBAGE program (May 1979) and brought to light three problems. The first is a real bug: the computer will on occasion after a "GO" situation, replay a card it has already played. The correction involves the addition of a line of code as follows:

```
2605 IF M5<>1 THEN 2730
```

The second problem is an irrelevant bug in that line 2710 should be I9=VC(B9,1). The line as currently written causes no problem, and may be entirely eliminated. This section of code is only used when the computer's hand consists of four 5's. The correction will cause the computer to play the first 5 in its hand; leaving the line as is or removing it causes the computer to play the fourth 5 in its hand.

The third problem turns out to be a bug which will appear or not appear depending on how a particular BASIC language processes FOR/NEXT loops. Consider the following instructions:

```
3210 FOR K=1 TO I
3220 FOR L=K+1 TO I
•
•
•
•
3270 NEXT L
3280 NEXT K
```

IBM BASIC evaluates the limit of the FOR/NEXT loop before processing the loop; therefore, when K reaches the value of I the FOR/NEXT loop on L will not be executed because I + 1 is greater than I to start. On the TRS-80 however, BASIC evaluates the limit of the FOR/NEXT loop at the end of the loop and therefore will execute the loop with L equal to I+1 which causes all sorts of problems during the play of the hand. To eliminate this "bug" (?) change line 3220 to read FOR L=K TO I.

Sheppard Yarrow
6513 Farmingdale Court
Derwood, MD 20855

◆

## What Happened To Computer Notes?

Dear Editor:

I am a new subscriber to **Creative Computing**, as suggested by Pertec because they were no longer going to publish a newsletter for MIT Altair users. I have two questions: (1) Will you, in the future, be publishing information for "us" Altair users who no longer have a common source for information about our equipment, and (2) I have a disk operating system and all of the programming I have learned re: disk has come from my own work. Will you be publishing information about disk programming? Thanks for any help you can give me.

R.M. Adelstein
10341 E. Evans #160
Denver, Colo. 80231

*When we bought the MITs publication,* **Computer Notes**, *we acquired their unprocessed manuscripts, their mailing list and that's about it. The same thing happened when we bought* **ROM Magazine**. *The manuscripts from both have since been processed and published in Creative. I haven't actively solicited manuscripts on Altair systems as a result of that purchase...but if any come over my desk they'll certainly get every consideration. —JTC*

## More Sorcerer Feedback

Dear Editor:

Some more Sorcerer feedback, in response to Michael Turniansky's letter in CC, Vol. 5, No. 4 (April, 1979):

By dint of luck, intuition, and trial and error, I discovered that the place to POKE your machine-language subroutine address is 260 (low byte) and 261 (high byte). That is, when you invoke USR control branches to the address specified in the (decimal) locations 260 and 261 in memory, with the address specified low byte first (as is standard for machine language commands). Unfortunately, I don't have a clue as to where, if anyplace, the USR parameter is placed, and where the returned value comes from. But this only means that a few extra PEEK's and POKE's are required to communicate with your subroutine. Thus, the sorely-needed INP function (get a character from the keyboard without waiting for a RETURN) can be simulated by something similar to the following:

**Initialization**

```
ST=0 :REM ARBITRARY START ADDRESS FOR SUB-
ROUTINE
IN= ST+? :REM ADDRESS FOR DUMPING INPUT
BYTE
HI=INT(IN/256) :REM HIGH BYTE OF INPUT ADDRESS
LO= IN-HI :REM LOW BYTE OF INPUT ADDRESS
POKE ST,205 :REM "CALL" (CD)
POKE ST+1,48: POKE ST+2,224 :REM "RECEIVE"
MONITOR ENTRY POINT (E030)
POKE ST+3,50 :REM "LD A" (32)
POKE ST+4,LO: POKE ST+5,HI :REM ADDRESS TO
WHICH A IS DUMPED
POKE ST+6,201 :REM "RET" :(C9)
T= INT(ST/256): T1=ST-T :REM GET LOW & HIGH
BYTES OF ST
POKE 260,T1: POKE 261,T :REM SET USR ADDRESS
```

The above routine loads a small machine language program into memory, starting at location ST. The program uses the monitor to get a keyboard byte in register A; this is then dumped into location IN, where a PEEK can retrieve it. Note that if it could be sent back as the value of USR, a variety of neat in-line functions could be created, instead of somewhat clumsier subroutines.

To use it, something like the following can be done:

```
FOR I=1 TO DL :REM DL IS SOME DELAY CONSTANT, #
OF TRIES BEFORE QUIT
CH=USR(0) :REM GET A CHARACTER — 0 IS A DUMMY
PARAMETER
CH=PEEK(IN) :REM PICK UP THE CHARACTER
GOTTEN
IF CH THEN RETURN :REM GOT IT, GO HOME
NEXT I :REM TRY AGAIN
RETURN :REM AFTER DL TRIES, GO HOME ANYWAY
```

Note that if other machine language routines are used in the same program, setting the USR address should be made part of the subroutine.

A word of caution: when invoking machine language routines in a BASIC program, save a copy **before** you test — you might crash the system and lose all your keying!

Incidentally, my prize for the maximum-return-for-minimum-effort program goes to Michael D. Zorn's SUPEROSE (April, 1979). The article is not only beautifully clear on adapting the routine to a variety of environments, it lets you produce astonishing effects for an investment of perhaps 5 minutes of keying. Terrific!

Eli Cohen
2236 Allison Rd.
Vancouver, B.C., Canada
V6T 1T6

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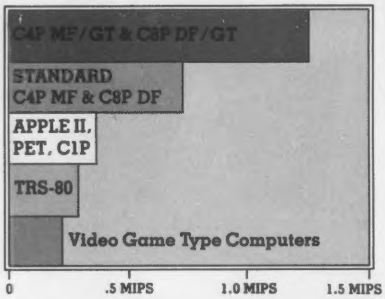
## SPEED

Speed separates the computers from the toys. The faster the processor executes instructions the more elaborate and greater the I/O can be. The C4P and C8P have execution speed that is twice as fast as Apple II, or Commodore PET and over THREE times as fast as TRS-80. They are many times faster than the recently introduced flock of video game type computers.

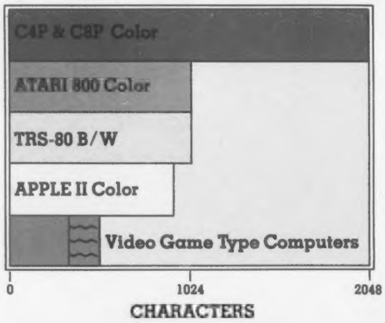
**GT OPTION** As if that weren't fast enough, the C4P and C8P's speed is nearly doubled when equipped with the Ohio Scientific GT option. By utilizing a 6502C microprocessor in conjunction with ultra-fast static memories, a C4P or C8P equipped with the GT option, will yield the following performance:

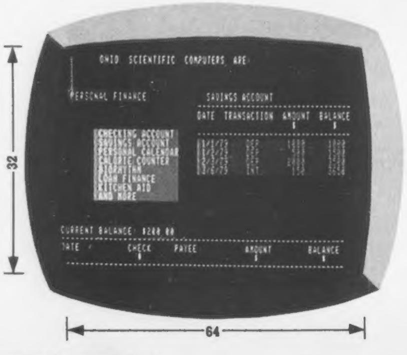
**1.2 million instructions per second. Average.**
**Memory to accumulator ADD time — 600NS.**
**JUMP extended — 900NS.**

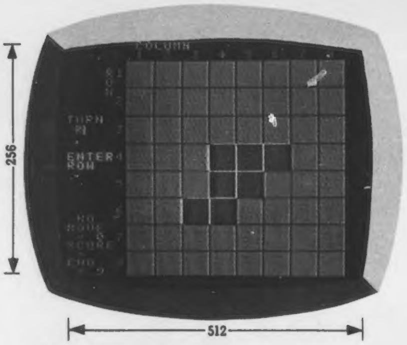


## DISPLAY

The C4P and the C8P offer more display than other personal computers — 2048 characters — 32 rows of 64 columns with upper and lower case. Long display width makes user instruction easier to program and to read. The effective graphics resolution of 256 x 512 points allows these computers to match the display limit of even the best color television sets.

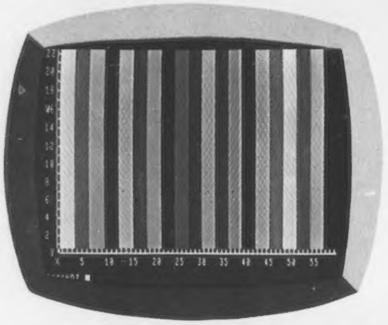






## 16 COLORS

The C4P and C8P offer a brilliant array of 16 colors including black available in both alphabetics and graphics.



## CONSTRUCTION

The C4P incorporates a fully RF shielded aluminum case with 2-step baked on enamel finish. It is trimmed with solid oiled walnut and die-cast chromed dress panels. Compare its construction to the plastic cases that are standard on other personal computers.

The quality doesn't stop at the surface. The C4P and C8P are modular BUS orientated computers with 4 and 8 slots respectively. The internal electronics are built to rigorous industrial standards.

Modularity means expandability and obsolescence protection. In fact, the original 1977 vintage C2-4P can be upgraded to a C4P by changing PC cards at substantially less cost than purchasing a new computer.

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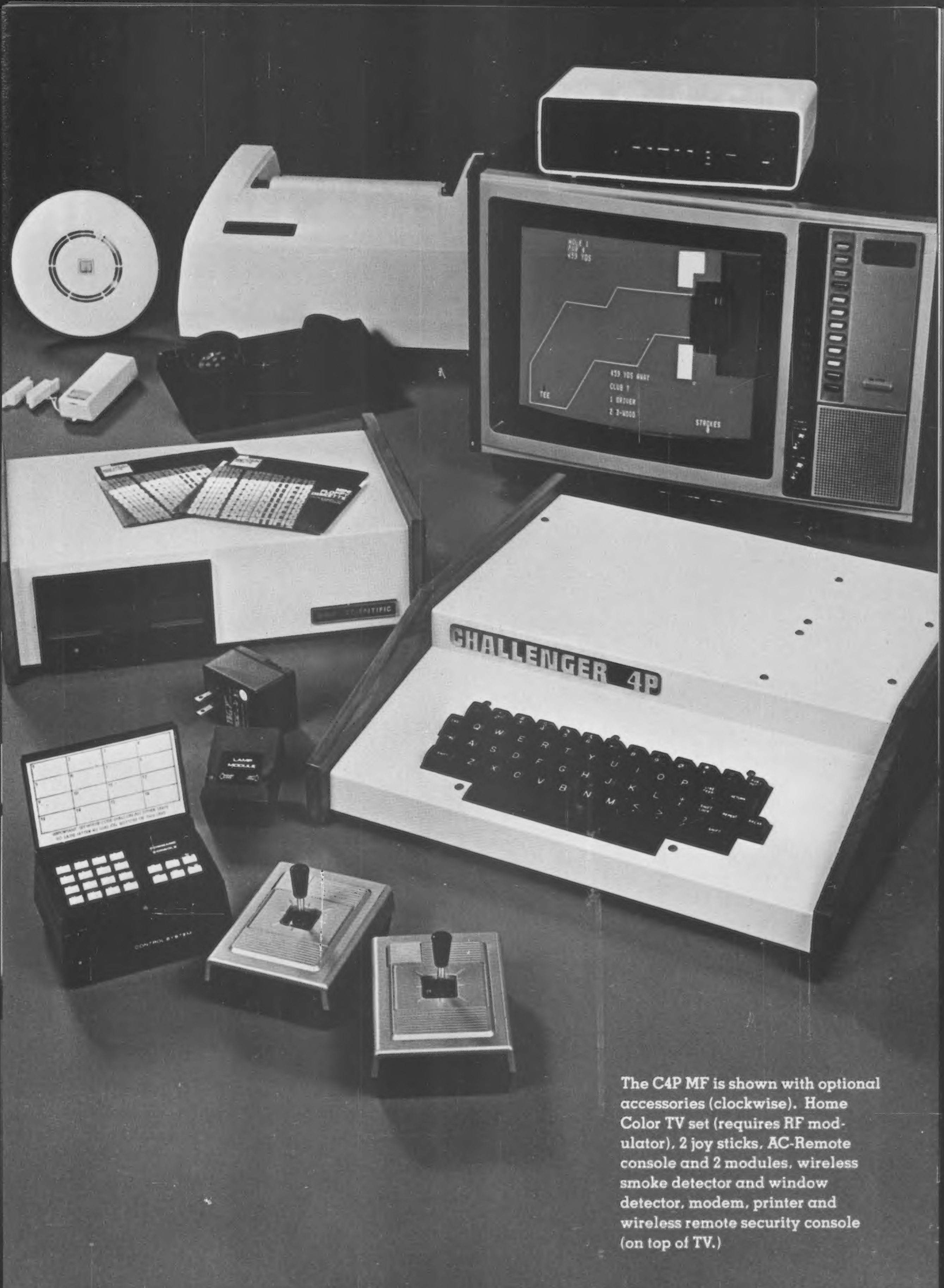
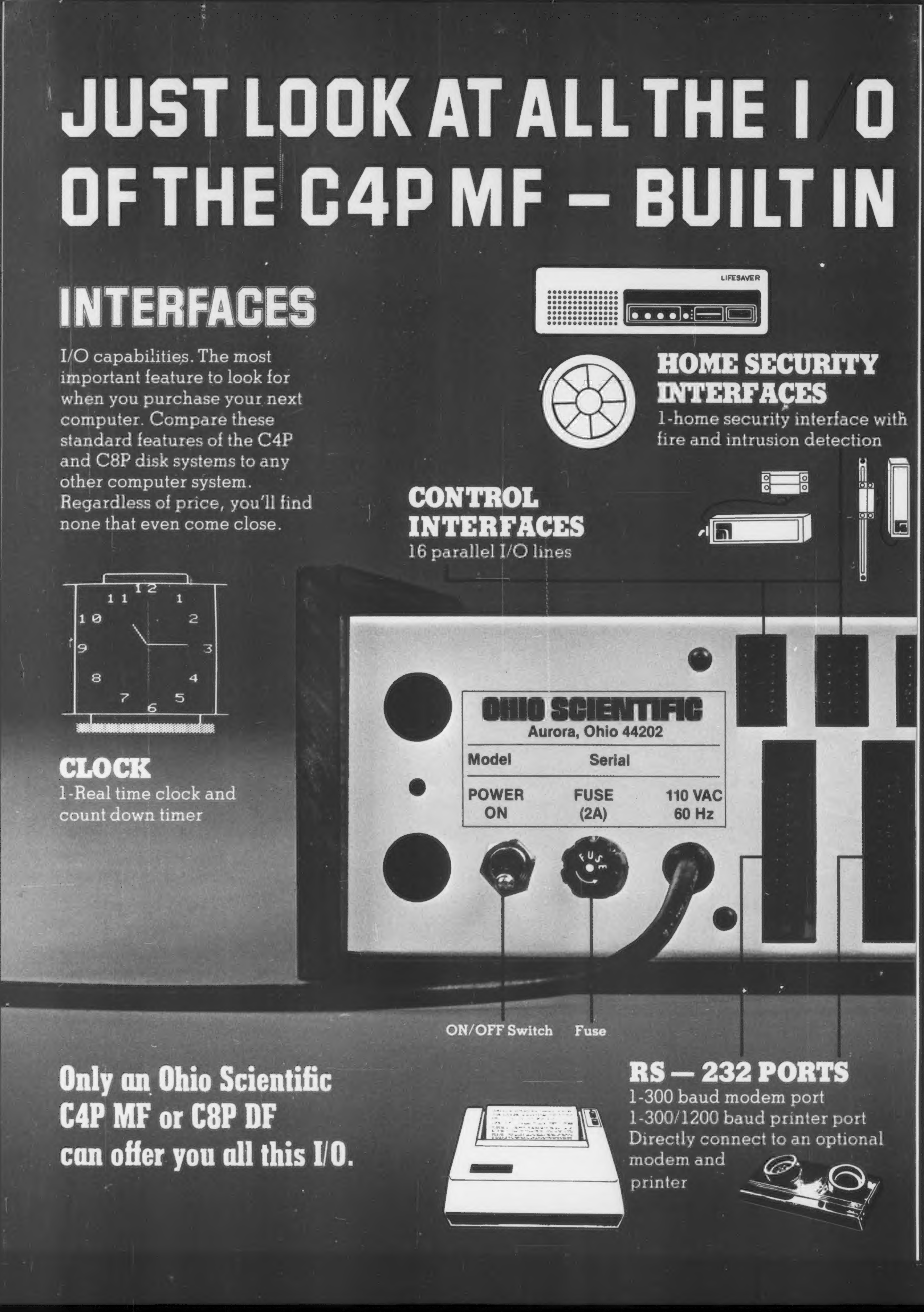
* Apple II, Commodore PET, TRS-80, and Atari 800 are registered trade names of Apple Computer Inc., Commodore Business Machines Ltd., Radio Shack, Atari, respectively.


HOLE 1
PAR 4
459 YDS
459 YDS AWAY
CLUB ?
1 DRIVER
2 3-WOOD
TEE
STROKES
SCIENTIFIC
CHALLENGER 4P
LAMP MODULE
CONTROL SYSTEM

The C4P MF is shown with optional accessories (clockwise). Home Color TV set (requires RF modulator), 2 joy sticks, AC-Remote console and 2 modules, wireless smoke detector and window detector, modem, printer and wireless remote security console (on top of TV.)


LIFESAVER
12
1
2
3
4
5
6
7
8
9
10
11
OHIO SCIENTIFIC
Aurora, Ohio 44202
Model
Serial
POWER ON
FUSE (2A)
110 VAC 60 Hz
FUSE
ON/OFF Switch
Fuse

# JUST LOOK AT ALL THE I/O OF THE C4P MF — BUILT IN

## INTERFACES

I/O capabilities. The most important feature to look for when you purchase your next computer. Compare these standard features of the C4P and C8P disk systems to any other computer system. Regardless of price, you'll find none that even come close.

**HOME SECURITY INTERFACES**
1-home security interface with fire and intrusion detection

**CONTROL INTERFACES**
16 parallel I/O lines

**CLOCK**
1-Real time clock and count down timer

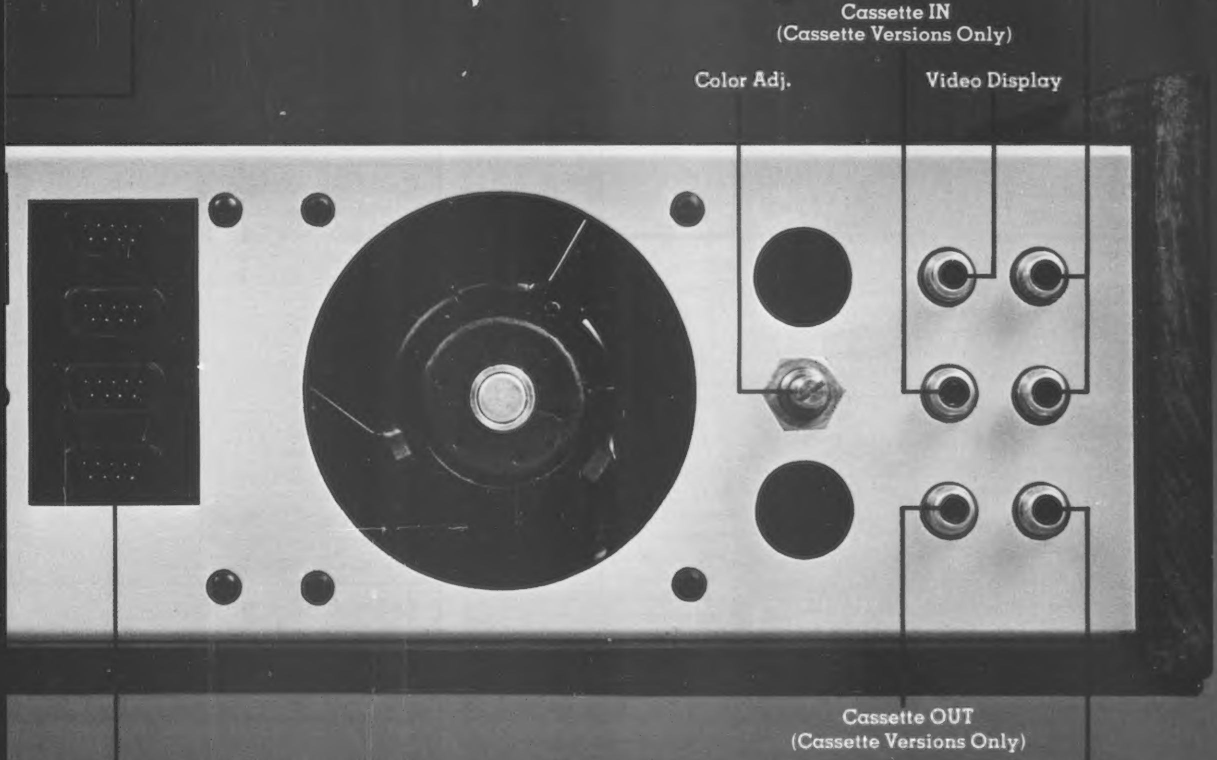
**RS — 232 PORTS**
1-300 baud modem port
1-300/1200 baud printer port
Directly connect to an optional modem and printer

**Only an Ohio Scientific C4P MF or C8P DF can offer you all this I/O.**

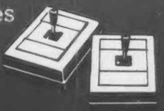
# AVAILABLE ON THE BACK AND READY TO RUN.

**ACCESSORY BUS**
One accessory BUS connector for an external 48 line I/O board, PROM blaster, analog data module or education board.

**SOUND**
1-programmable tone generator 200 — 20KHz
1-8 bit companding digital to analog converter (DAC) for music and voice output


Cassette IN
(Cassette Versions Only)
Color Adj.
Video Display
Cassette OUT
(Cassette Versions Only)

**HUMAN INPUT EXPANSION**
2-8 axis joystick interfaces
2-10 keypad interfaces



**HOME INTERFACES**
1—AC-12 AC remote control interface

# SOFTWARE

Ohio Scientific offers a full comprehensive library of both systems and applications software for the C4P and the C8P. And, because our main language is Microsoft BASIC like most other personal computers, much of your old software can be used on the C4P and C8P with little or no modification except for the special I/O functions and the much faster speed of your new computer. This would include software from the TRS-80 Level II, Apple floating point BASIC, Commodore BASIC and many others.

## SYSTEMS INTEGRATION

There is a lot of software available for a lot of computers. Unfortunately for the user in almost every case the computer is available from one supplier, software is available from a dozen independent suppliers and accessory devices are available from yet other suppliers. Ohio Scientific has a different approach. We offer a comprehensive library of systems and applications software for the 4P and 8P. In fact, we offer more factory supported software than any other personal computer company. For example, say you have a brand X computer and you buy a real time clock from company Y which supplies software to use the clock. Then you buy an AC controller from company Z who also provides software. The system works fine as long as you want to monitor time or control AC devices but you are out of luck when you want to use the clock in conjunction with controlling AC devices. With Ohio Scientific's systems you can be monitoring home security, time, controlling AC devices and be playing an exciting video game, all at the same time because the systems software, the applications software, and the accessories *form an integrated package which works together without end user modification.*

OHIO SCIENTIFIC MICRO-COMPUTER SOFTWARE
FLOPPY DISKETTE
OHIO SCIENTIFIC
OHIO SCIENTIFIC SOFTWARE

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## FOREGROUND/ BACKGROUND OPERATION

This means that your computer can be engaging in home monitoring activities at the same time it is running other programs.

# EXPANSION

As you can see, the C4P and C8P are truly exceptional premium computers with just their standard features alone. Above and beyond that they are easily expandable to add exciting advanced features like word processing, additional memory, voice I/O, and our new universal telephone interface (UTI).

## C4P VS. C8P

The C4P is a 4-slot portable computer with one open slot for expansion. The C8P is an 8-slot mainframe class computer with five open slots. It features over 3 times the expansion capability of the C4P for advanced home, experimental and small business applications. The C8P's dual 8″ floppies store about 8 times the information of a single mini-floppy and access it many times faster.

## ADVANCED FEATURES FOR C8P DF EXPANSION

### Voice I/O

The C8P DF can be optionally equipped with a voice I/O system that includes a Votrax module capable of generating English speech phonetically. It also has provisions for a user populated 5-channel feature extractor for voice input experimentation.

### Universal Telephone Interface (UTI)

Optionally equipped with a Universal Telephone Interface system, the C8P DF has the ability to dial any telephone number, utilizing rotary dial or touch tone telephone lines. It can respond to touch tone or modem signals and can route voice to tape recorders.

It can answer by touch tone, modem, stored message or Votrax voice output (when equipped with Votrax module or used in conjunction with a CA-14 Voice I/O.)

A C8P DF with UTI, voice output, AC-Remote, home security and its clock yield the home computer of the future with uncannily human-like capabilities to communicate via phone lines and operate and monitor typical home functions.

# FINAL FACTS

Buying a new computer is a serious, long-term investment. So we invite you to shop around and compare. The closest thing you'll find to a C4P or C8P will cost twice as much and offer less than half the performance. We know. Because there's nothing like these exceptional premium computers at any price, anywhere. And probably won't be for a very long time.

# SPECIFICATION CHART

| FEATURE |
|---|
| Microprocessor type GT option 6502C |
| Full 53-key Keyboard |
| BASIC in ROM |
| BASIC on Disk |
| Minimal Config. RAM |
| Minimal Config. Total Memory RAM + Display + ROM |
| Maximum RAM |
| TV/Video Monitor |
| Cassette Recorder |
| Mini-Floppy Disk |
| Dual Mini-Floppy Disk |
| Dual 8″ Floppy Disk |
| Video Display |
| Color Graphics (up to 16 colors), Upper and Lower Case, Graphics + Gaming Elements |
| Effective Screen Resolution |
| Audio Output (200 to 20KHz) |
| DAC for Voice and Music Generation |
| Key Pad Interfaces |
| Joystick Interfaces |
| AC Remote Control Interface |
| Audio Cassette Interface |
| Real Time Clock |
| Home Security System Interface |
| Printer Interface |
| Modem Interface |
| 16 Parallel Lines + Acc'y. BUS |
| GT Option |
| Winchester Hard Disks Option |
| Voice I/O |
| Telephone Interface |

---

*TRS-80 Level II, Apple floating point BASIC and Commodore BASIC are registered trade names of, Radio Shack, Apple Computer Inc., Commodore Business Machines Ltd., respectively.

| C4P | C4P MF | C8P | C8P DF |
|---|---|---|---|
| 6502 | 6502A | 6502 | 6502A |
| Yes | Yes | Yes | Yes |
| Yes | No | Yes | No |
| No | Yes | No | Yes |
| 8K | 24K | 8K | 32K |
| 19.5K | 27.5K | 19.5K | 35.5K |
| 32K | 48K | 32K | 48K |
| Acc'y. | Acc'y. | Acc'y. | Acc'y. |
| Acc'y. | No | Acc'y. | No |
| Acc'y. | Yes | No | No |
| Acc'y. | Acc'y. | No | No |
| No | No | Acc'y. | Yes |
| 32 x 64 | 32 x 64 | 32 x 64 | 32 x 64 |
| Yes | Yes | Yes | Yes |
| 256 x 512 | 256 x 512 | 256 x 512 | 256 x 512 |
| Yes | Yes | Yes | Yes |
| Yes | Yes | Yes | Yes |
| Yes | Yes | Yes | Yes |
| Yes | Yes | Yes | Yes |
| Yes | Yes | Yes | Yes |
| Yes | No | Yes | No |
| No | Yes | No | Yes |
| No | Yes | No | Yes |
| Yes* | Yes | Yes* | Yes |
| No | Yes | No | Yes |
| No | Yes | No | Yes |
| No | Acc'y. | No | Acc'y. |
| No | No | Acc'y. | Acc'y. |
| No | No | Acc'y. | Acc'y. |
| No | No | Acc'y. | Acc'y. |

*Not wired to connector.

C4P
CHALLENGER 4P

C4P MF
CHALLENGER 4P

C8P
CHALLENGER 8P

C8P DF
CHALLENGER 8P

Computers come with keyboards and floppies where specified. Other equipment shown is optional.

# HARDWARE

## COMPUTERS

| | | |
|---|---|---|
| **C4P** | 8K BASIC in ROM, 8K RAM, Demo Cassette | $ 698 |
| **C4P MF** | 24K RAM, Single Mini-Floppy, OS-65D 3.1 operating system and 2 demo disks | 1,695 |
| **C8P** | 8K BASIC in ROM, 8K RAM, Demo Cassette | 895 |
| **C8P DF** | 32K RAM Dual 8" floppies, OS-65D 3.1 and 2 demo disks. | 2,597 |

### ACCESSORIES

| C4P | C4P MF | C8P | C8P DF | | | |
|---|---|---|---|---|---|---|
| ● | ● | ● | ● | **AC-3P** | 12" B/W Combination Monitor/TV | $ 115 |
| ● | ● | ● | ● | **AC-15P** | 12" Color Monitor | 399 |
| ● | ● | ● | ● | **AC-16P** | 2—8 Axis Joy sticks with cables | 39 |
| | ● | | ● | **AC-11P** | Answer/Originate 300 baud modem with cable | 199 |
| ● | ● | ● | ● | **AC-12P** | AC-Remote starter set, console, 2 lamp modules, 2 appliance modules, OS-65D home control operating system. | 175 |
| | ● | | ● | **AC-17P** | Home security starter set (wireless), console, 1 fire detector 2-window units, one door unit and Demonstration software. | 249 |
| | | ● | ● | **CA-15** | Universal telephone interface with touch tone encoder / decoder, 300 baud orginate / answer modem, analog signal mux / demux. | 499 |
| | | ● | ● | **CA-15V** | As above with Votrax voice module for computer generated voice response. | 799 |

### PRINTERS

| C4P | C4P MF | C8P | C8P DF | | | |
|---|---|---|---|---|---|---|
| ● | ● | ● | ● | **AC-18P** | Low cost high speed 8½" aluminized paper printer with upper/lower case. | $ 695 |
| | | ● | ● | **AC-9TP** | Centronics 779 110 cps tractor feed Business printer with interface. | 1,250 |
| | ● | ● | ● | **AC-14** | NEC Spinwriter—word processing printer with high speed parallel Interface. | 2,795 |

### GT OPTIONS (must be purchased with computer)

| C4P | C4P MF | C8P | C8P DF | | | |
|---|---|---|---|---|---|---|
| | ● | | | **C4P MF/GT** | 24K, 120NS Memory, 6502C processor, 2-speed clock. | add $ 950 |
| | | | ● | **C8P DF/GT** | 48K, 120NS Memory, 6502C processor, 2 speed clock. | add 1,825 |

For other expansion accessories such as add-on memory, additional floppy drives and other accessory boards consult the current full line price list.

# SOFTWARE

Here is a partial listing of diskettes for the C4P and C8P. For a complete listing of diskettes and cassettes consult the current full line price list.

### APPLICATIONS SOFTWARE

| | | |
|---|---|---|
| **Game Disk 1** | Arcade games | $ 29 |
| **Game Disk 2** | Arcade games | 29 |
| **Game Disk 3** | Popular Conventional Computer games | 29 |
| **Game Disk 4** | Popular Conventional Computer games | 29 |
| **Game Disk 5** | Advanced Arcade games | 29 |
| **Game Disk 6** | Advanced Arcade games | 29 |
| **Game Disk 7** | Joy stick Arcade games | 29 |
| **Game Disk 8** | Animations and Cartoons (2 disk set) | 29 |
| **Personal Disk 1** | Checking/Savings/Loans/Etc. | 29 |
| **Personal Disk 2** | More personal programs | 29 |
| **Education Disk 1** | Educational games | 29 |
| **Education Disk 2** | BASIC tutor series | 29 |
| **Education Disk 3** | Tests/tutors/drills | 29 |

### BUSINESS SOFTWARE

| | | |
|---|---|---|
| **Business Disk 1** | Depreciation/return on investments etc.... | $ 29 |
| **Business Disk 2** | Mailing list/Address list/etc.... | 29 |
| **OS-WP2** | Complete word processing system | 200 |
| **OS-MDMS** | 65D based Data Base Manager and information management system. A must for business use. | 49 |
| **MDMS-A/R** | Accounts Receivable System | 29 |
| **MDMS-A/P** | Accounts Payable System | 29 |
| **MDMS-Inventory** | Inventory System | 29 |
| **MDMS-Aux. 1** | Sort/File packer/key File editor for ISAM | 29 |

### UTILITIES

| | | |
|---|---|---|
| **65D Aux. 1** | Sort/packer/memory test/disassembler | $ 29 |
| **Graphics 1** | Color graphics utilities with high resolution plot package | 29 |
| **Home Control 2** | Advanced home control program using AC-12 and AC-17 | 29 |
| **DAC Routines 1** | Music composition system with chord generation capability | 39 |

**Purchase your C4P or C8P and accessories direct from your local Ohio Scientific dealer. Over 300 dealers nationwide.**

**OHIO SCIENTIFIC**

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creative computing
EQUIPMENT PROFILE

**Seven applications that you can do with digital imaging**

# Periphicon 511 Optical Image Digitizer

**William J. Blewett**

## Introduction

Do you want to sort plywood by counting knotholes, or are you interested in robotics, optics, security devices or chess? This article describes an exciting new low-cost peripheral with applications in all the above areas, the Periphicon digital camera. Its full name is the Type 511 Optical Image Digitizer. Figure 1 is a list of the manufacturer's specifications and Figure 2 is a sample portrait of the author.

**Specifications**

| | |
|---|---|
| RESOLUTION: | 32 by 32 pixel array; square format. |
| SPECTRAL RESPONSE: | Infra-red to near UV; silicon curve. |
| SENSITIVITY: | Equivalent to ASA 200 emulsion. |
| FIELD OF VIEW: | 18 cm at 1 metre. |
| LENS: | fl. 9/13mm<br>focus from 0.2m. to infinity. |
| MOUNTING: | 1/4-20 optical mount |
| I/O: | TTL level; 6 contact edge card. |
| DIMENSIONS: | 8.2 cm wide<br>4.0 cm high<br>2.5 cm deep, excluding lens and connector. |

Figure 1. Specifications.

First, I would like to describe the very simple hardware of the camera itself and the basic process of getting an image on the screen. The main point to be made is that the camera is so simple (hence its low cost of approximately $200) that at first glance one wonders if it can be useful for any application. Second, I would like to describe a few of the stunning variety of visual effects and applications possible by the use of various software image processing techniques. In some of these applications some additional hardware would also be necessary but nothing expensive or complicated is required.

The operating principle of the camera is simple. Light entering through the lens is focused not onto film as in an ordinary camera, but rather onto a 32x32 array of light sensitive elements called pixels. As time passes, each pixel of the CCD (Change Coupled Device) array reaches a saturation point where it changes from a low to a high state.

A microprocessor can sample the array at any time reading a zero or a one for each pixel and the image can then be reproduced on the screen. Even if your microprocessor system does not have any graphics capability (i.e., point plotting, etc.) the image can still be reproduced by using a character for each pixel, the blank character for a zero and the ASCII "A" for a one, for example.

There is no shutter on the camera since this function is performed when the computer resets the CCD array. Both the resetting and subsequent reading of the array is performed serially bit by bit. This ensures that each pixel is exposed the same amount of time when it is read. The array can be read repeatedly without resetting if desired.

There is a focus control on the camera and, in addition, at least three different close-up lenses are available at approximately $10 apiece.

## Motion Pictures

Although this camera looks like an ordinary hand-held still-life camera, the fact that it can generate a new image many times a second means that it also functions as a movie camera. In the simplest mode of operation the microprocessor resets the CCD array, waits for a short time, reads the array and creates an image on the screen. By repeating this procedure over and over, the effect of moving pictures is created. In actual practice, under normal fluorescent room lighting, the camera can produce about three images per second. At this speed it is quite easy to watch yourself moving around the room or waving your hand, for instance. By storing each successive image in memory (or possibly on disks or tapes) it is possible to create movies which can be played back at the same or higher speed. Of course, the resolution is very low compared to film.

The Periphicon Type 511 Optical Image Digitizer.

Additionally, the fluorescent light which I used is a particularly poor illumination source since it is pulsed. Under incandescent light it should be possible to generate images at a rate of from 20 to 60 frames per second.

## Pictures With Shading

The quality of the pictures produced by the camera can be enhanced by adding shading. Once the microprocessor resets the CCD array, it can begin reading the array repeatedly and storing each "frame" that is read into memory. In practice about five frames can be read before all of the

---

William Blewett, Box 1107, Sudden Valley, Bellingham, WA 98225.

pixels become saturated. In the first frame only a few pixels will be turned on where the light is brightest, and each successive frame will show an increasing area of saturation. Since each pixel is represented in memory by a one or a zero, a shaded picture consisting of six grey-levels (0 to 5) can be produced by arithmetically adding all of the frames together. Of course each pixel in the composite frame can no longer be represented by only a single bit. However, to save time and memory, each frame can be added in as it is read from the camera.

This technique requires one K of RAM for the composite frame if a single byte per pixel is used. Of course, it is possible to pack two or four pixels per byte if necessary. When the composite frame is completed it can be displayed by choosing an appropriate character for each grey-level value. Note that little or no speed has to be sacrificed for the grey-level effect since the microprocessor is using time that would otherwise be wasted.

### Motion Detector

One of the most useful applications of the system considered so far is to use the camera to detect moving objects. Such an ability will allow the camera to be used as a security device. Mounted inconspicuously inside or outside your house, the camera is ready to instantly alert you should it detect the presence of any moving object and, in addition, the detector software is able to filter out unwanted false alarms caused by noise or changing light levels.

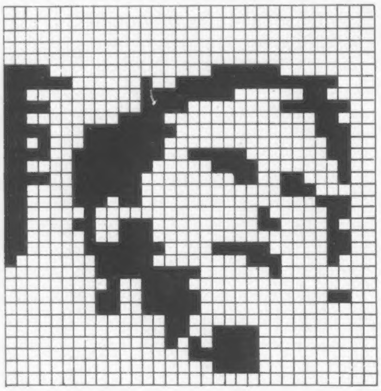

Figure 2. "Portrait" of the author.

The trick to doing all of this is ridiculously simple. Simply "Exclusive OR" each pair of successive pictures together. Wherever a pixel has changed from on to off (or off to on) between the two pictures will result in a logical one (1) in the resulting array matrix. Otherwise the matrix will be filled with zeroes.

To describe what is happening visually, suppose the camera is pointing at a still-life scene and the Exclusive OR matrix is being displayed on the screen. Since each successive picture is identical, the screen will look completely blank! Now, if an object moves into the field of view, an outline of the object will show up on the screen. At this point a quantitative estimate of the "amount" of motion can be obtained by adding together the cells of the matrix. This is important since, due to noise and other factors, a few cells (typically 4 or 5) will flicker on and off even when there is no motion. By setting the alarm activation level at a threshold value of 20, for example, it is possible to detect people passing an open doorway about twenty feet from the camera, without false alarms.

Suppose now, that you wish to use the camera in conjunction with an automatic light sequencer while you are away from home. When room lights are turned on or off automatically by the sequencer, many pixels will change in the camera image and this will be incorrectly interpreted as motion and set off the alarm. Of course, if the light sequencer is also run by your computer, the light sequencer software can briefly deactivate the camera software while the lights are being changed. However, it is generally desirable to build system modules as independently as possible so that each module needs to know only about its own task. This design principle eliminates many bugs and complications. Thus the camera software should be able to distinguish motion from an instantaneous lighting change instead of relying on the sequencer.

The solution is simply to require that motion (pixel change greater than a threshold value) be detected over two or more successive matrices, that is, over a period of time greater than two successive pictures. This will catch intruders but not detect your room lights.

### Outlines And Contours

The use of the Exclusive OR operation in the motion detector is very suggestive of further applications. So far it enables the computer to detect the outlines or edges of moving objects only. If the same could be done for stationary objects as well, the computer might be able to attempt some scene analysis. This leads to the possibility of using the camera as an eye for a robot.

The first idea that comes to mind is to move the camera back and forth. As far as the software is concerned, it can't tell if the camera is moving and the scene is still, or vice versa. Therefore it should detect edges in the still-life scene. However, the physical motion of the camera (involving motors and tracks, etc.) is a complication that is not really necessary at this stage.

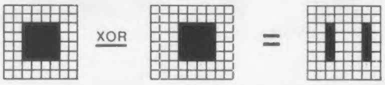

Figure 3. The Exclusive OR operation as applied to a picture of a square shifted one dot to the right. Note that the resolution of the camera (32x32) is greater than that indicated by this example (8x8).

The trick is to realize that moving the camera (a small distance) physically is equivalent to having light from the scene fall on different (nearby) pixels in the retina. Why not just compare a picture with itself shifted over one dot, and keep the camera and the scene stationary.

For instance, Figure 3 shows the result of XOR'ing a (very simple) picture of a square which has been shifted one dot to the right. The left edge on the square is detected because that column of pixels changed from dark to light. The right edge is detected for the opposite reason. Note that the top and bottom edges of the square were not detected at all.

In general, the technique is most sensitive to edges which are normal (perpendicular) to the direction of shift. By repeating the process with the shift in a vertical direction, the

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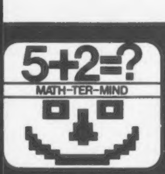
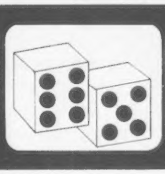


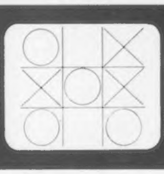
Math-Ter-Mind®

Lunar Lander



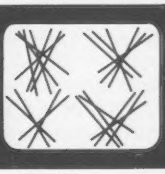
Craps

Mastermind



Tic-Tac-Toe

Jungle Island®



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CIRCLE 106 ON READER SERVICE CARD

## Periphicon 511, con't...

outline of the square can be completed. Also, shifts at 45 degree angles can be performed to help detect diagonal edges.

Note also that the two edges in Figure 4 are five cells apart although the original square was only four cells wide. This apparent expansion can be corrected by shifting one dot to the left all edges which are created by pixels changing from light to dark only.

### Another Application - Chess

Suppose you have a program for playing your favorite board game with your computer but are getting tired of always having to type in your moves. Consider mounting the camera above the board so that your computer can "see" what is happening during the game.

In chess, for instance, the camera could be positioned so that each square of the board is covered by a sixteen (4x4) pixel area. This is sufficient resolution to distinguish blank from non-blank squares. Distinguishing individual pieces may also be possible but is not really necessary if the computer already knows the piece locations, since it can update the board based on which squares have changed from blank to non-blank or vice versa.

Suppose it is your turn to make a move in a chess game. The computer knows the current position and, in addition, is keeping an eye on the board with the motion detector software. Now, as you pick up a piece to make your move, the computer detects the motion of your hand and knows that the board position is changing. It waits for the image to once again stabilize so that it can compare the new position with the old.

The piece that has moved is easy to identify since some square that formerly held a piece is now blank. If the piece has moved (but not captured), its destination is also easy to identify as the square that is now non-blank. Only in the case where a piece has made one of two or more possible captures is there ambiguity. Then it is a question of deciding which capture is the correct one. It may be necessary to keep the keyboard for this purpose (to enter the move symbolically) but consider the following scenario.

The computer, being indecisive about where the capture has been made, displays a message asking the user to touch the piece! As this is done, the computer tracks the moving arm and finger until it stops. The board and pieces, being motionless, are of course subtracted out of each image. See Figure 4 for a sample of what this looks like. I leave it to the reader to devise a method of locating the tip of the finger in an arbitrary image of this sort. Once this is done the computer need only decide which of the candidate squares is nearest the fingertip. The computer then displays "thank you," the player withdraws his arm, and the game continues.

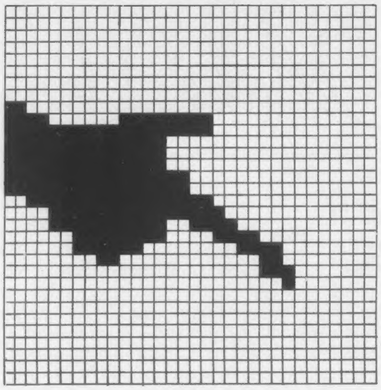

Figure 4. Image of a hand.

Of course it may be possible (perhaps by redesigning the chess pieces slightly) for the computer to distinguish individual pieces and thus be able to accurately track the progress of the game at all times.

### Color Pictures

By using a technique similar to that used by early color television cameras, the basic black and white image can be enhanced with color. It is necessary to obtain three color filters in each of the primary colors; red, green and blue. Colored cellophane for this purpose can generally be obtained from fine arts stores at less than a dollar a sheet.

The technique is to take three pictures in succession, one through each filter, and combine them into a single picture. The resulting picture can contain six different colors plus black and white depending on which combination of filters contributed to each individual pixel. By combining this with the shading technique already mentioned, many more colored shades and tones can be produced. Note also that it is not necessary to reproduce similar colors on the screen to those of the original objects. Color inverting or highlighting is simply a matter of mapping different colors onto the computer generated image.

10-4 GOOD BUDDY! WHAT'S YOUR 20?
Bucella

*"Well, it's not cobol and pretty sure it's not fortran and..."* ©Creative Computing

To combine the color technique with the "movies" effect, it will be necessary to mount the color filters on a rotating disk such that an electrical connection is made as each filter rotates into position in front of the camera. This signal must of course be made available to the CPU in some way, as through an input port.

**The Periphicon digital camera has a seemingly endless number of applications.**

### Infra-Red Pictures

In addition to visible light, the CCD array is highly sensitive to the infra-red spectrum. In fact, the manufacturer claims that the maximum sensitivity of the camera occurs in the near-infra-red region. I have not yet tested this capability, but it should be possible to take pictures or detect motion in total darkness. I would however, expect that the addition of an infra-red light source would be necessary for this purpose. If the process is feasible, it will of course increase the camera's utility as a security device.

### Conclusions

The Periphicon digital camera has a seemingly endless number of applications. This combined with its low cost, small size and rugged construction make it one of the most exciting computer peripherals I've seen. It is, however, very sensitive to the type of illumination source, incandescent being the best. ☐

Periphicon, P.O. Box 324, Beaverton, OR 97005, (503) 646-9869.

# YOUR COMPANY!

Pictured from left to right starting in first row: Del, Sturgis, Linda, Alan, Sandy, Cassandra, Gail, Frank, Dosse, Dale, Mike, Barry. Carol and Brian are not pictured.

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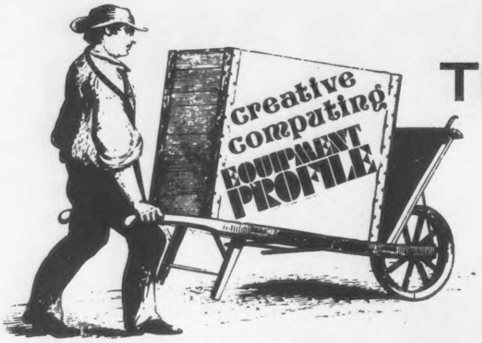


# The Renaissance Machine: Compucolor II

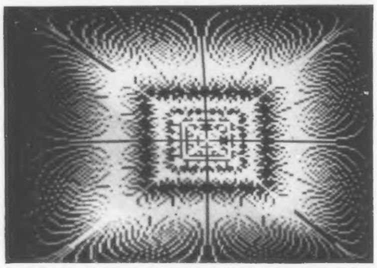
**Dennis Martin**

There are many things to look for when buying a microcomputer. The most important in my mind is the base system price and what it includes. When it comes to assembling kits, I'm just not interested. I want something I can take out of the box, plug in and start running. After taking a serious look at most of the systems available, Compucolor II won out.

Consider the base system:

13 inch color monitor
Mini-floppy disk drive
Full keyboard 72 keys
Extended disk BASIC in ROM
128 x 128 8-color graphics

all for only $1495.00!



A sample of graphic designs that can be created with the CCII.

### Languages

The CCII comes with 17K extended disk BASIC in ROM. To enter BASIC, just turn the CCII on and the message : DISK BASIC 8001 V6.78 COPYRIGHT© BY COMPUCOLOR MAXIMUM RAM AVAILABLE? appears at the top of the screen. You can then enter the amount of RAM you want, or hit 'return' and the system will default to the maximum amount of RAM available. You are now ready to program to your heart's content.

BASIC in the CCII is much like other BASIC's, but with a few notable differences. You must be careful when programming because you have 8 colors and 2 character sizes. Color or character height can only be changed when enclosed in quotes or in a REM statement. If you don't do it right, you will get an awful lot of needless syntax errors. The most notable difference is the use of the PLOT command. With this command you can change colors at any time, character sizes at any time, draw bar graphs, lines from point to point, complete cursor control (including blind cursor), access disk while still in BASIC and print any ASCII character. **Whew!** There are more, but that should give you an idea of the versatility of the PLOT command. As a result of this command ability, programs written especially for the CCII will be hard to translate to other BASICs.

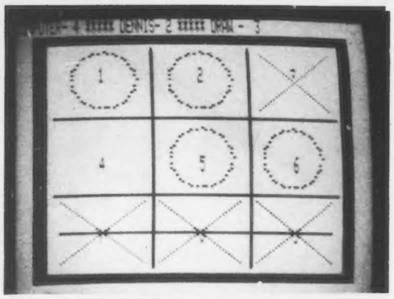
BASIC consists of 29 statement types, 3 command types, 17 math functions, 9 string functions and 13 disk commands.

The CCII also has, as an option, 8080 Assembler on disk for $24.95. The Assembler disk comes with a manual, and requires 16K of RAM. A Text Editor is also an option that requires 16K. Cost for the Text Editor and manual is $24.95. **NOTE: The Text Editor can be used by itself, but the 8080 Assembler requires the use of the Text Editor. So, unless you want to write your own Text Editor, you have to buy them both.**

**Operating the CCII on metal tables sets up interference from the CRT, causing read and write errors. This problem is easily corrected by finding another table, or lifting the CRT up off the table.**

### The Renaissance Machine

The 'Renaissance Machine,' as Compucolor calls it, is a single board computer with a 2MHz 8080A microprocessor. A 13" color screen offers you an interesting form of I/O, and unexpected ease in formatting output.



TIC-TAC-TOE with full color graphics.

The mini-floppy is a Wangco Model 82 which is located to the right of the screen. Disks are inserted on edge into the drive, and both sides of the disk can be used. Maximum storage per disk is 102.4K using both sides. One problem has crept up with putting the drive in the CRT cabinet. Operating the CCII on metal tables sets up interference from the CRT, causing read and write errors. This problem is easily corrected by finding another table, or lifting the CRT up off of the table. You should then be able to load or save your programs. A metal table will not interfere with the running of the computer itself, only the disk drive. The disk is not the quietest one I've ever heard, either. At times it sounds as if it is literally digesting the disk, perhaps this is just because the plastic CRT cabinet amplifies the sound. I haven't had a disk eaten yet, so I'm not worried about it. At least I know when a disk is being accessed!

The disks themselves are not the ordinary off-the-shelf disks. They have to be purchased from Compucolor or one of their dealers. Compucolor will not release their formatting program, and the CCII cannot format its own disks. The disks from Compucolor are only 2 for $9.95, which is certainly cheap enough. If you are really interested in formatting your own disks, various people have written a formatting program and will

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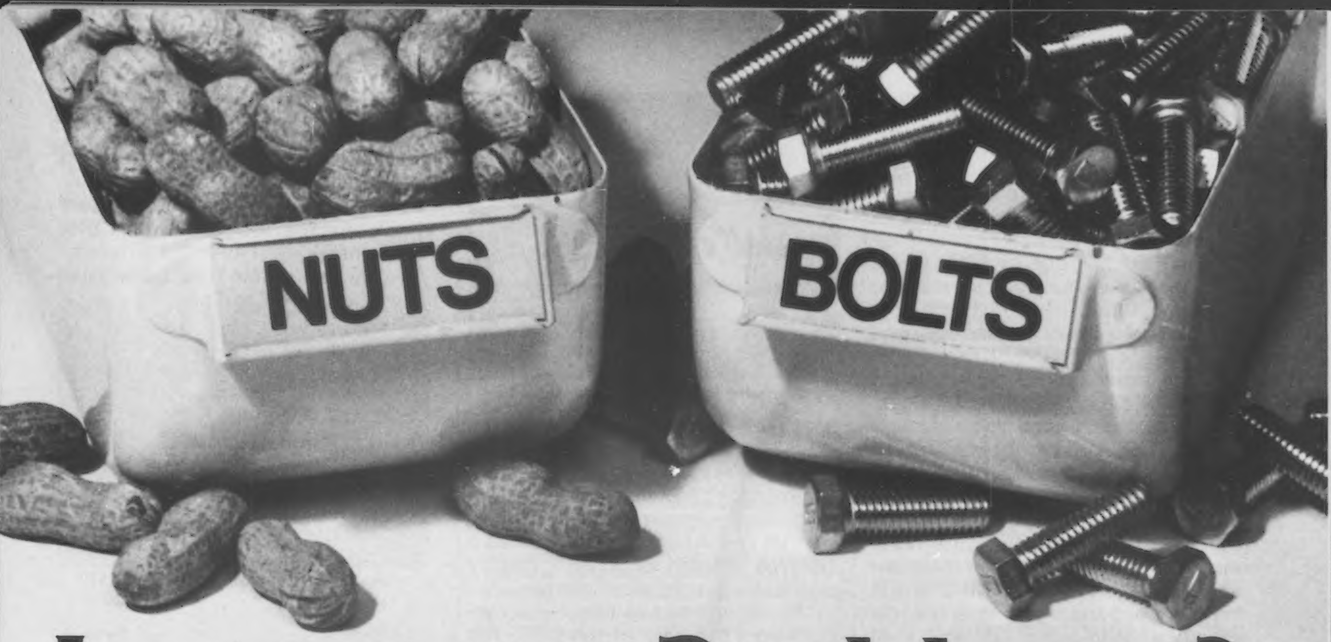
Dennis Martin, 4817 Sahler Apt. 9, Omaha, NE 68104.



# Inventory Problems?

Are you having trouble keeping the right nuts and bolts in stock? Since even a simple mistake can cost you time and money, a good inventory system should do more than just count parts. It should tell you exactly what you need, when you need it, where to get it, and how much it will cost.

The MSI Inventory System Seven enables you to maintain a versatile data base for controlling inventory. It lists part number, description, quantity on hand, vendor, cost, selling price, optional pricing, usage levels for previous month, present month, and year-to-date, and much more.

When quantity on hand items reach minimum levels, the System Seven compiles an automatic reorder list. This list can be generated by specific vendor as well as a complete listing of all materials to be ordered.

In addition to the item listing, the Inventory System Seven "bill of materials" provides you with a complete inventory of items used in the manufacture of subassemblies and complete products. It also contains other cost items such as labor costs, total raw materials costs, and miscellaneous costs.

The MSI Inventory System Seven is built around the versatile MSI 6800A Computer with 56K of RAM. An integral dual mini-floppy memory gives you an additional 630K of memory and makes inventory control fast and efficient. The System Seven will interface with any industry standard CRT, and you have the option of both a "daisy wheel" word processor for high quality document preparation and a dot matrix printer for high speed production.

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CIRCLE 158 ON READER SERVICE CARD

## Compucolor II, con't...

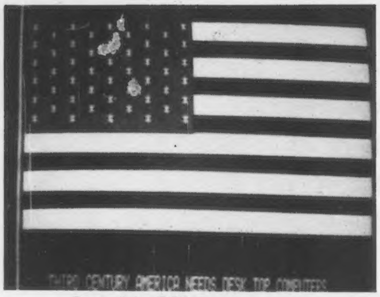
sell it to you for around $100.00. That's a little steep in my book, so I'll stick with the $5 per disk.

The CRT has one problem which Compucolor will help you correct free of charge. When they constructed the circuit board for the video display, they left out the horizontal pin cushion, which causes an inward bowing of the screen on both sides. Compucolor will send you the components free, you get them installed. Installing them is not hard, because the PC board is marked and all parts are easily placed in their proper positions. Getting it fine tuned is another matter. Unless you have the maintenance manual ($50), or have a dealer install the parts, you won't know exactly what to adjust. When it's all installed and adjusted, you no longer have the bowed sides, and your display looks a lot better.

The keyboard is unbelievable. There are 72 keys altogether, each with a variety of functions. With the caps lock on each key is in its normal mode. With caps lock off you get special graphics characters. Hitting ESCape and another key simultaneously will cause a variety of responses, from entering disk file control system to vertical print mode. The Control key being depressed at the same time as another key will allow you to change colors, enter plot modes, or transmit the entire display to the RS-232 port. By depressing Control, Shift, and any other key, a BASIC command will be typed on the screen. Once you learn where they're all at, its much easier to hit Control/Shift/L than to type in GOSUB.

**Compucolor does not have its own printer, but can use almost any printer available with an RS-232 connector.**

The CCII has a built-in RS-232 port. This makes the CCII easy to interface to a variety of devices. Baud rate is keyboard selectable with 7 rates available, 110-9600. You also have a choice of 1 or 2 stop bits, and full or half duplex. Correct parity is required however, because the CCII transmits and receives 8-bit ASCII characters and data which precludes parity checking. If you wish to use the CCII as a terminal on a system that uses 7-bit codes, a separate program in RAM is required to translate. The CCII will respond to almost every control code or escape sequence and, as a result, you may have to have another computer treat the CCII as a Teletype instead of a CRT display terminal to get proper responses.



Part of the CCII demo program.

The 50 pin bus is directly accessible from the back of the CRT. The complete pin-out is given in the Owners Manual. For the hardware oriented hobbyist, it shouldn't be too hard to interface S-100 boards to the CCII. I would advise being very careful, and a little chat with one of Compucolor's technicians might be very helpful.

### Expansion

The list of add-on features for the CCII is a small one. To expand to 16K of RAM will cost you $200, and from there to 32K is another $375. It also requires the removal of your current chips to put the new ones in. All RAM chips are soldered in place except for the last 16K, which is a plug in board. **NOTE: You can't expand to 24K, because the address chip isn't set up for it.** Two optional keyboards are also available. A 101 key keyboard is $135 extra, and a 117 key keyboard is $200. These keyboards have number pads and color clusters, and the deluxe model also has 16 special function keys which can be user-defined. One additional disk drive can be added for $400. This drive is housed in its own cabinet and is connected by a ribbon cable to the back of the CCII.

Compucolor does not have its own printer, but can use almost any printer available with an RS-232 connector. This leaves you open to get whatever you need instead of taking what the manufacturer decides is right for you.

### Software

Compucolor has a growing list of Sof-Disks available. All machines come with their Sampler disk which includes a demo program, Concentration Game, One-Armed Bandit, Biorhythms, Loan and Repayment Schedule, Memory Diagnostics program, English/Metric Conversions and a disk copy program. Some of the popular Sof-Disks are:

Math Tutor—Math Tutor, Checkbook, Recipe Program, Math Dice, Biorythms.
Star Trek—Star Trek, Lunar Landing, Shoot, Tic-Tac-Toe
Hangman—Hangman, Math Tutor, Two to Ten.
Chess*—Chess, Acey Deucey, Line Five, Biorhythms
Othello—Othello, Math Dice, Concentration (Numbers), Concentration (Letters)
Text Editor*
Assembler for the 8080*
Blackjack
Cubic Tic-Tac-Toe*
Personal Finance (Vols. I and II)
Bonds*
Equity*
Personal Data Base
*indicates 16K RAM required.

Three more games disks and several educational and statistical disks are to be released in upcoming months.

### Documentation

The Instruction Manual included with each system is 16 pages long. Though short, it is still enough to get you started. Most of its pages are taken up with how to operate the CCII properly. It gives you a list of all the commands, but does not tell you how to use these commands properly in a program. The average beginner might get started, but unless he shells out another $25 for the programming manual, he will get discouraged rather quickly.

**The Programming and Reference Manual is a must for anyone wanting to do any kind of serious programming on the CCII.**

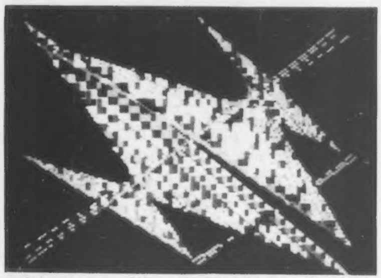
The Programming and Reference Manual is a must for anyone wanting to do any kind of serious programming on the CCII. The 150 pages contain everything in the Instruction Manual, plus much more.

The manual, though not well written in parts, is essential to the person wanting to fully utilize his computer, and I recommend everyone who has a CCII to have it. Hopefully, later editions of the manual will explain things in more detail.

The Maintenance Manual is definitely not for everyone. If you're good

## Compucolor II, con't...

at reading schematics, and don't have a dealer handy, it might not be a bad investment. For $50 you get a full set of schematics, plus instructions on how to fix almost anything that might go wrong.



An example of the color graphics available on the CCII.

### User's Files

Compucolor maintains a User's File, where a user can exchange programs. If a program is good enough, Compucolor might decide to buy it from you. They will pay up to $1000 for original programs, depending on complexity, size and ease of use. Compucolor prefers to swap out merchandise for programs instead of paying cash, so for those of you looking to expand your present systems, it's a cheap way of doing it. One thing to note, however, is when you sell them a program, they obtain all rights to, and have sole distributorship of it.

**Compucolor maintains a User's File, where a user can exchange programs. If a program is good enough, Compucolor might decide to buy it from you.**

### Future Plans

One area that Compucolor is going to expand upon is the available ROM. I have it from a reliable source that Compucolor is going to make an additional 8K of ROM available. They're still not sure what to put in it, but such things as double precision and renumbering of programs are a couple of ideas I've heard. Other than that, the only place left for them to explore is software development.

Should you buy a Compucolor? That depends on what you want in a computer. For the average user that doesn't require more than 32K of useable RAM, I don't think you can beat it! ☐

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Total Enclosed $ ________
(Conn res add tax)

**CHARGE IT!** Exp Date ______
☐ Visa ☐ Master Charge
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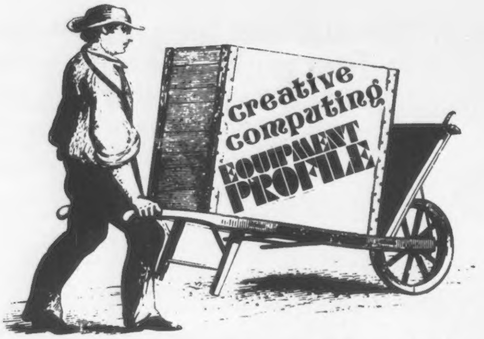

## Build It Yourself Or Buy It Assembled

# Heath H14 Printer

### Jim Wright

With printers ranging from several hundred dollars to several thousand dollars, it is important to make a list of your minimum requirements as well as a list of desirable features. This list, including your budget limitations, can then be used to compare the various printers available. In my particular case I needed a printer capable of both upper and lower case printing on 8½" wide paper. Although I am a very satisfied TRS-80 user, my basic requirement eliminated the Radio Shack printers from my list. The TRS-80 Quick Printer uses 4.75" aluminum finish paper and the TRS-80 Line Printers (26-1150 and 26-1152) do not print lower case characters.

From my list of desirable features, I wanted an impact printer that could use individual sheet, roll, or fanfold paper. This would eliminate thermal or electrosensitive type printers such as the TI Silent or the TRS-80 Quick Printer, respectively. I also desired a printer that would print at least 300 baud (30 characters/second). Having used a Teletype Model 33, which prints at 110 baud (10 characters/second), this "desirable" feature was right on the edge of making my basic requirements list. As I planned to do quite a bit of writing, I needed a printer with typewriter quality characters such as generated by the IBM Selectric or Diablo terminals. And finally, to support business programming and reports, the last desirable feature was a printer capable of plotting graphs.

---

Jim Wright, 10140 NW 43rd St., Coral Springs, FL 33065.

### A Printer In Kit Form

After reviewing my basic and desirable features list I discovered that my "ideal" printer would be a Diablo. Unfortunately, the Diablo failed in only one area...it was beyond my budget. Well, back to those **Creative Computing** ads and catalog sheets! Just about this time, those fine folks in Benton Harbor were mailing their Winter Heathkit catalog. There on page 74: "NEW H14 Line Printer gives you 'hard copy' output of your programs...$595"! The H14 is the kit version of Heathkit's WH-14 $895 assembled line printer introduced in the Fall of 1978. (The WH-14 was one of the potential printers on my list, but at $895 it was pushing the top end of my budget). The H14 specifications were excellent. 5x7 dot matrix impact upper and lower case characters, standard .5" nylon inked (typewriter) ribbon, selectable baud rates from 110 to 4800, up to 9.5" edge punched fanfold paper, selectable line lengths of 80/96/132 characters per line; and a feature I have not seen on most expensive printers, selectable line spacing of 6 lines/inch or 8 lines/inch.

Although the H14 did not satisfy all of my desired features, it filled all of my basic requirements and, considering the price, I was willing to compromise on some of my desired features. The following day I called Heathkit's Computer Sales and Information number (616-982-3285) to see if the H14 printer could interface with the TRS-80. The girl I talked to was very courteous but really wasn't sure if the printer would directly interface with the Radio Shack computer. She did offer to send me a specification sheet and suggested I call Heathkit's computer technical assistance number (616-982-3309) for further information. After rereading the catalog and the specification sheet, I was convinced that the H14 printer would have no problem interfacing to any computer with an RS-232 serial or 20 mA current loop port. As I was currently using a borrowed Model 33 printer with a homemade 20 mA current loop interface similar to that sold by Small Systems Software (TRS232 Printer Interface at $49.95), I saw no difficulties in connecting the H14 to my TRS-80. Therefore, I placed an order for one.

### Construction

Construction of the H14 line printer consists of two main areas; the printed circuit board and the printer mechanics. I began at 9:30 on a Saturday morning by unpacking all of the PC board components. Following the step by step instructions I inserted, soldered and trimmed all of the approximately 200 PC board components by 3:15 in the afternoon. The only mistake I made in the assembly

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()

ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789

ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[
```

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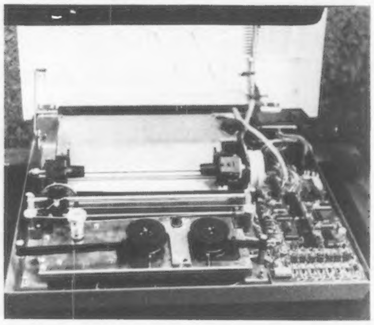
## H14 Printer, con't...

of the PC board is when I inserted a .33 ohm resistor in place of a 330 ohm...ya gotta watch those color codes closely! The error became evident when I went to find the .33 ohm resistor several steps later.

The second part of the kit's construction is the assembly of the switches, power supply and mechanics. After unpacking and checking the remaining parts I began the second phase. I spent several hours Saturday night and Sunday morning assembling all of the mechanical parts. I was now ready for the final assembly steps. One of the most welcome features of the printer kit is that Heathkit provides a fully assembled wiring harness to interconnect the various parts of the printer. It took about one and a half hours to do the final wiring and begin the checkout. Photo shows the inside of the completed H14 printer.



### Will It Work

Probably the most concerning part of building a kit is plugging it in for the first time. Images of wisps of smoke or blown ICs go through your mind. Well, again Heathkit helps the builder by providing a series of tests to perform before the power is applied and then another series of tests before the final ICs are installed. These tests do require the use of an ohmmeter and voltmeter. However, after these tests, Heath provides onboard LEDs to test the remaining operating logic of the printer. Not only do these tests help check out the printer after assembly, they can be used to troubleshoot the printer should it ever develop a problem. Heathkit has reprinted the step by step testing procedure in the operator's manual so you needn't worry if you misplace the construction manual. With the exception of my misreading an IC designator and using the wrong test point on a series of tests, my printer checked out perfectly. I was now ready to print my first line...but where do you buy fanfold paper 10 PM on a Sunday night? Well, Heathkit must have really designed this kit for someone like me because they were smart enough to include a one inch package of paper for those of us who forget to read all the "battery not included" notices.

After loading the paper I pressed the test button inside the printer and "grrrrrrrr" there was a complete line of all the characters printed out in less than two seconds. For the next fifteen minutes I experimented with all of the switch options and printed out several pages of test lines until all of a sudden the print head moved across the paper but no printing occurred! Oh no, not the $133 print head... ?*!#$!....

### Problems

After using the troubleshooting chart provided in the operating manual I was able to trace the problem down to a blown fuse. This was the printhead protective fuse which was provided as a .6 amp slo-blow but the PC board marking and the schematic showed it as a 1 amp fast blow. As I luckily had a 1 amp fast blow fuse I used that as a replacement. The printer again worked properly... whew! Curious as to why the fuse blew, I began to look around the print head. It appeared that one of the printhead hammers somehow got caught on the ribbon. This apparently caused excessive stress and resulted in the blowing of the fuse. After further investigation as to why the printhead would get caught I found the source of the problem. The pawl and rachet mechanism that advances the ribbon was not working properly and allowed the ribbon to slacken. This slack was enough to catch the printhead. The solution was simply to loosen one of the screws slightly which allowed the ratchet spring to properly secure the ribbon.

Several days later when I was printing out a string of #####'s I blew three 1 amp slo blow fuses in a row. This only happened when I tried to print that one particular string. Totally baffled, I called Heathkit's technical assistance number. The technician I talked to suggested that I replace the 1 amp fast blow fuse with a .6 amp slo blow. The only slo blow fuses I had were .5 amps so I tried one. That was the last fuse problem I had. One comforting thing is that the printhead appears to be well protected from improper operation.

### Interfacing

Convinced that the H14 printer was assembled correctly I connected it to the homemade RS232 Serial interface circuit inside of my TRS-80. Heathkit provides a six foot cable terminated with the standard 25 pin male EIA connector to make interconnection to most standard interface units very simple. Placing the printer "on line," I typed LPRINT "Hello" into the TRS-80. After pressing the ENTER key I watched the printer expecting the same thrill Gutenberg must have had. It can't take that long, after all this is a "high speed" printer... Now what? I tried several times unsuccessfully to get the printer to print anything. Convinced that the printer logic was ok I started looking at the interface circuit on the schematic, as well as my home made circuit. Aha! Pins 5, 6 and 8 listed as Clear To Send, Data Set Ready, and Received Line Signal Detect were footnoted as not required for printer operation. My interface (and I believe Small System Software's TRS232) have B+ on these pins. The quickest way to check if this was my problem was to push out these three pins in connector S2 inside the printer. Again trying my LPRINT "HELLO", I heard a fsssst... the TRS-80 was now talking to the H14! Overcome with my success I loaded in one of my BASIC programs and typed LLIST. There it was, a source listing of my program. Well almost! About 20% of the characters were misprinted. Now what? I knew that the interface circuit worked as I had been using it with the Model 33.

After several evenings of experimenting with different ideas (I didn't have a scope to check out the waveforms), I finally concluded that my homebuilt interface was not **consistently** providing sufficient levels to the H14. The manual indicates that the H14 wants to see a minimum of 5 volts for a SPACE and -5 volts for a MARK (see Figure 1). After changing a few biasing resistors in my interface I was able to get it to provide what the H14 considered to be an acceptable signal. Once I was sending the proper levels, my Heathkit printer worked fine.

For those of you who don't want to build your own interface or write the required printer driver program you can use one of the several RS232 Serial interface circuits now on the market. If you encounter any interface problems check out the areas I have mentioned above. If it is a no print problem try disconnecting the pins in the H14 as outlined. If it appears to be a level problem you might have to contact the interface manufacturer.

## H14 Printer, con't...

### What Can It Do

That seems to be the first question anyone asks of a computer or peripheral device. Figure 2 shows the character set of the H14. Note that the 80, 96, and 132 characters/line densities do not all produce the exact same 8" line that one would expect based on 10, 12, and 16.5 characters/inch as specified. This slight variation will probably not cause any problems unless you intermix densities for graphics. It should be pointed out that as the H14 is a line printer (that is, it buffers and prints out one complete line at a time versus printing a character at a time), you cannot mix line densities within a line. If you need to intramix densities on one line there is a way to do it with BASIC programming by printing over the same line several times inhibiting the carriage return at the end of each pass.

The H14 front panel is equipped with two LEDs and six pushbutton switches. One LED and switch provide for ON/OFF. The WIDE CHAR switch sets the print density to 80 char/in. or 132 char/in. Three switches control the paper motion. TOP FORM, FEED REV, and FEED FWD provide the indicated functions if the remaining ON LINE switch is not set (i.e., off line). The remaining LED is a HIGH TEMP light. This LED will light when the maximum printhead temperature is reached.

In addition to the hardware control of the printer the H14 also can be controlled by software commands providing quite a bit of flexibility in programming. Software commands include setting the line density, line spacing, as well as generating a line feed, carriage return and form feed. With the combination of hardware and software controls, the H14 has tremendous versatility to meet almost any hard copy needs.

### Conclusion

At $300 less than its assembled counterpart, the H14 printer represents an excellent value. The H14 features and operation compare very favorably to many printers costing $1000-$1500. While the H14 did not have all of the features I would have liked (a pinch roller option), and had some minor annoyances (paper hold down springs were too weak), I have to rate this printer very high overall. If you are looking to add a printer to your computer system, consider very carefully building the Heathkit H14. ☐

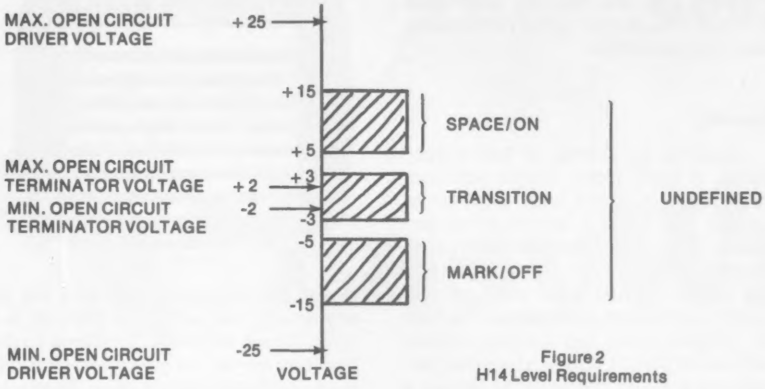

MAX. OPEN CIRCUIT DRIVER VOLTAGE
+25
+15
+5
SPACE/ON
MAX. OPEN CIRCUIT TERMINATOR VOLTAGE
+2
+3
TRANSITION
UNDEFINED
MIN. OPEN CIRCUIT TERMINATOR VOLTAGE
-2
-3
-5
MARK/OFF
-15
MIN. OPEN CIRCUIT DRIVER VOLTAGE
-25
VOLTAGE

Figure 2
H14 Level Requirements

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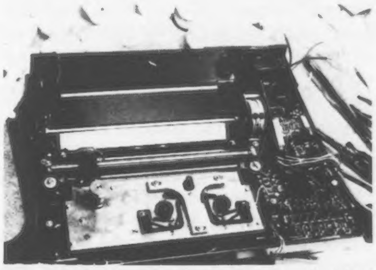
## Creative's Experience With The H14

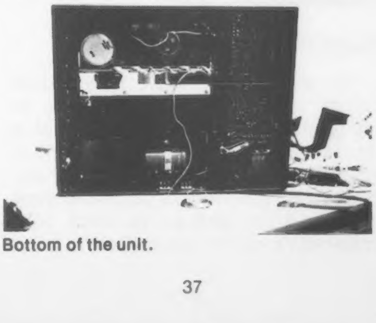
Creative's experiences with the construction of the H-14 printer were similar to those of Jim Wright. We found construction to be very straightforward. Indeed, it was easy compared to the Heathkit H-9 video terminal and Solid State Music VB1-B video interface card, both of which had several hard-to-diagnose bad parts. The H-14 printer took us about thirty-three hours for construction. We found one mistake in the assembly manual in the section on testing. If the kitbuilder was to follow the instructions verbatim, one would arrive at the conclusion that Heathkit provided three bad transistors, but this was not the case. The changes in the manual, provided over the phone by Heath, were simple; on page 76 in the second to last step of the second column, Q202 should read Q201; in the last step, Q204 should read Q202. On page 77 in the first step, Q201 should read Q204 and the second step should read "...with the 5 hook-up wire..." instead of the 11 wire.

Like Jim Wright we also blew out the 6/10 amp. fuse. One area that might stand improvement is replacing the relatively weak springs used in the ribbon advancement mechanism. Nevertheless, we consider the H-14 printer to be an outstanding value. For $595, we know of no other printer that provides upper and lower case, good speed (135 cps), tractor feed, variable line width and spacing and both EIA and 20 ma current loop interfaces. Whatever your computer, this printer is an excellent complement. — Jeff Yuan.

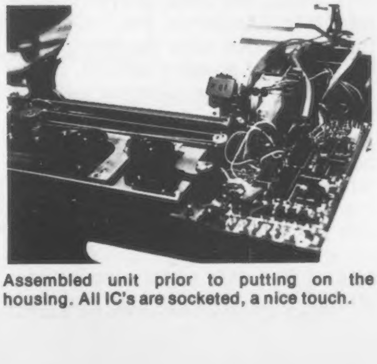
We sorted all the many small parts into about two dozen paper muffin cups. If you build the printer, you'll want to use a similar approacb rather than hunting each time you need a ½" 6-32 phillips head screw.



Top of the unit during final electrical assembly.



Bottom of the unit.

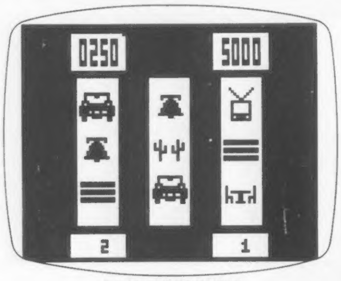


Assembled unit prior to putting on the housing. All IC's are socketed, a nice touch.

# Atari Video Computer Cartridges

### David H. Ahl

As anybody who's been reading these pages regularly knows, Atari provides some of the best games cartridges for their video computer system, and consistently produces new cartridges to support the system. There are twelve new entries for 1979; here are our evaluations of ten of them.



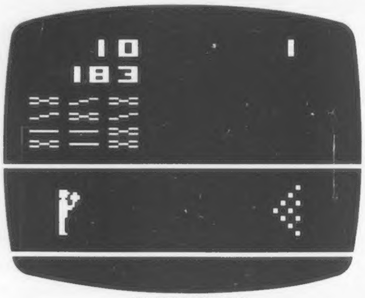
SLOT MACHINE™GAME PROGRAM™

## Slot Machine

The Slot Machine program simulates a 3-wheel, 20-stop slot machine such as those found in Las Vegas or Atlantic City Casinos. It can be played by one player against the computer, or by two players. There are four major variations, two of them are jackpot games and two are payoff games. Jackpot games have lineups of bars or cars and produce jackpots ranging from 20 to 200 points. The payoff games have more potential lineups of little symbols, such as cacti, tables and chairs, television sets, bells, and bars; payoffs range from 2 to 200 points. We found that the game either went by very quickly or, if you got an early jackpot, lasted quite a long time. Getting an early jackpot tends to alter your playing strategy. If you get one, you tend to bet five coins (the maximum permitted) on each round and thereby increase the size of future jackpots. The game is over when one or the other player goes bankrupt. Although lots of fun, this game also demonstrates how quickly one can lose one's money in a real casino. Be thankful you are playing with fake coins (although the game will already have cost you $20).

## Bowling

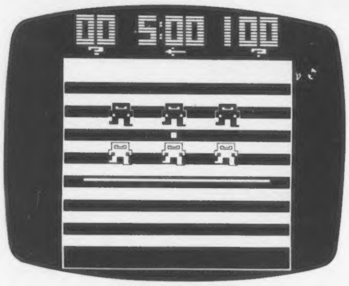
Bowling is a one or two-player game. A little man, which you can move up and down with a joystick, comes out on the left side of the screen. There are ten pins set up at the end of the alley on the right side of the screen. When your man is correctly positioned you release the ball by pressing the red button. Game variations permit you to steer the ball as it rolls down the alley or to put a curve on it as it leaves the player's hand. There are two skill levels. At the higher level it is harder to achieve spares and strikes (although we found it wasn't particularly easy even at the lower level). The sounds make this a lively game as the pins tumble or you score a strike or a spare and a tune plays. The player with the highest score at the end of ten frames wins the game.



BOWLING GAME PROGRAM™

## Football

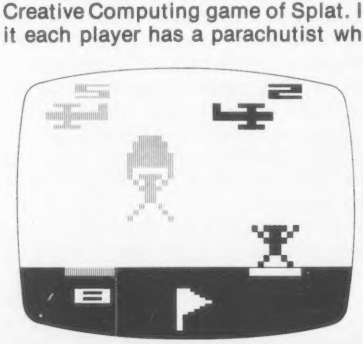
In this game each player has control of a team of four white or orange football players (which look a lot like flickering frogs as they move from one end of the field to the other). With your joystick you can move your team as a unit and try to block your opponent's run or pass. Before each play, you use your joystick to set up any one of four initial formations or a punt. There are three variations to the Football game: In game one you use the joystick to control your players all the way down the field. In game two the players follow exactly the play that you program in at the beginning, but you do not have any control of them as they run. Game three is similar to game two except that you may kick the ball at any time or punt at appropriate times. The game is five minutes long and has a large clock at the center top of the screen that keeps track of the time remaining. Also at the top of the screen are the scores for both players and the down indicator. Summing up, this game isn't as good as some computer simulations of football that we've seen, but it does boast lively action and is fun to play.



FOOTBALL GAME PROGRAM™

## Sky Diver

Sky Diver is modelled after the Creative Computing game of Splat. In it each player has a parachutist who



SKY DIVER™GAME PROGRAM™

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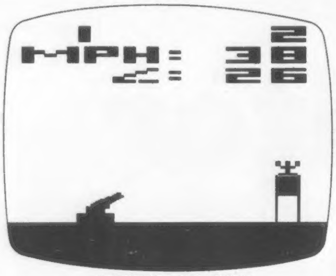
**CIRCLE 203 ON READER SERVICE CARD**

## Cartridges, con't...

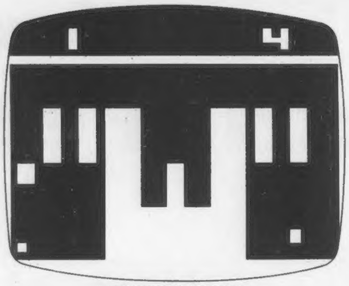
jumps out of the plane when the red joystick button is pressed. The direction of the parachutist may be controlled as he falls both before and after the chute is open. The object is to land on a small landing pad at the bottom of the screen. In some of the game variations landing pads move back and forth, while in others the size of the pads is decreased. You can score from 0 to 11 points per jump depending upon the length of time you wait before opening the chute and the accuracy of your landing. There is a point in the descent after which the parachute can no longer be opened. If your sky diver hits the ground with an unopened chute, you lose four points. We judge this as one of the best of Atari's new releases.



HUMAN CANNONBALL GAME PROGRAM™

### Human Cannonball

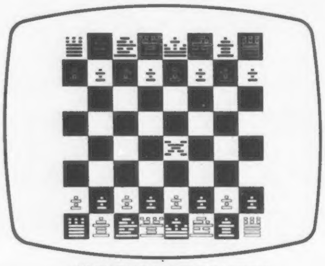
According to the instruction booklet the human cannonball is counting on you to make your calculations accurately or he'll end up flat as a pancake and you'll end up with zero points or a miss to show for your efforts. The object of this game is to shoot the man out of the cannon and into the water tower. To accomplish this you must consider the angle of the cannon, the speed at which the man travels and the distance between the cannon and the water tower. The game has a moving window through which you must shoot the man in four of the variations and a smaller water tower at the higher difficulty level. This game was modelled after the highly addictive and popular game of "Shoot" written by Art Luehrmann at Dartmouth a number of years ago and subsequently adopted for many microcomputers and other graphics terminals. We found it good fun, although once one gets to know the angle and cannon velocity for a particular distance between the cannon and water tower the game loses some of its initial challenge. On the other hand, you can restore that challenge quickly by trying the moving window variations or the smaller water tower.



MINIATURE GOLF GAME PROGRAM™

### Miniature Golf

This game simulates a nine hole miniature golf course. In it you hit the ball toward the cup. Each time you hit the ball it is called, appropriately enough, a stroke. The difference between this game and actual miniature golf is that you can take a good hard swing at the ball and hit it off the edges of the screen and the barriers around the course. Each hole is shaped differently so the ball bounces differently. In addition, each hole has an obstacle that moves back and forth across the area through which the ball must travel. When the obstacle collides with the ball, rather unexpected things happen. It can help you, but most of the time it gets in your way. The game has one and two player variations and two difficulty levels. Once we got the knack of it, Miniature Golf turned out to be one of our favorites.

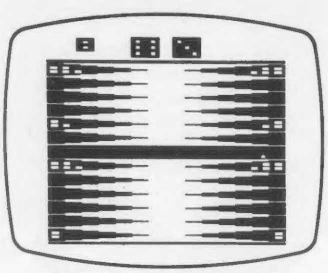


VIDEO CHESS Game Program™

### Video Chess

This cartridge is, as it's name implies, yet another computer chess game. (Readers of Creative ought to be familiar with the various chess games by now, so we'll focus mainly on the differences and extensions of this particular version.) Unlike some others, Video Chess permits captures "en Passant" and castling. Either the computer or the player may move first. A nice feature is the ability to set up the board for a particular chess problem. There are eight different levels of skill, with the computer taking from ten seconds to 24 hours to make a move. We found the computer a challenging player even at the lowest (ten seconds per move) skill level and a very significant challenge at level four (15 minutes per move). We did not go on to higher variations but, clearly, expert players will want to do so. With so many computer chess games around we've come to expect real excellence in the graphic representation of the pieces and board. While these graphics were good, they were certainly not in the high excellence category.

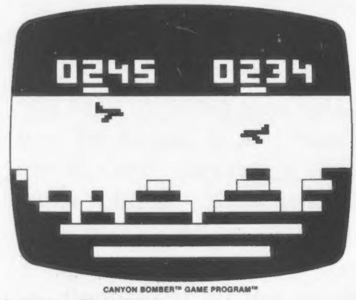
The journey of a thousand miles begins with a single step.



BACKGAMMON Game Program™

### Backgammon

This version of the game plays by the "standard" rules. It permits doubling and also allows you to set up problems that can be executed from midway through the game. There are variations for one and two players. The cartridge also includes four variations of Acey Deucey. (While this is frequently thought to be a card game—and indeed there is an Acey Deucey card game and computer variation of it—this Acey Deucey is the Backgammon game.) This cartridge would be excellent for someone learning Backgammon and provides an interesting challenge for beginning to intermediate players.



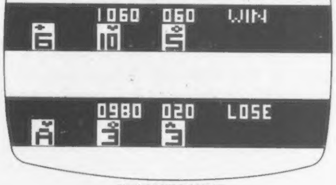
CANYON BOMBER™ GAME PROGRAM™

### Canyon Bomber

This cartridge is modeled after the popular coin-operated game in which airplanes fly from either side of the screen, releasing bombs on a number of rows of different colored bricks.

## Cartridges, con't...

The bombs can explode up to four bricks at a time. It's easy at first when every bomb hits. However, as the game progresses there are fewer and fewer bricks remaining and the bombs have a greater chance of missing. The game is continued until one player misses six times. The player with the highest score at this point is the winner. Some of the variations allow the bricks to tumble into the canyon as the layers underneath are blasted away, while others suspend the bricks in mid air. Two variations have unlimited bombs and go on until all the bricks in the canyon are eliminated. Two other games on this cartridge are in the sea bomber family in which you have to move the depth guage to one of five levels of passing ships and submarines where you wish your depth charges to explode. These are fast moving action games and were enjoyed by youngsters as well as adults.



CASINO™ GAME PROGRAM™

### Casino

This cartridge contains four games: two variations of Blackjack, Stud Poker, and Poker Solitaire. What more can be said about Blackjack? Yes, it plays the standard game and allows for doubling down, insurance bets, and splitting (although a player may only split a hand once). Blackjack allows up to four players and a dealer. Each player receives a "bank" of a 1000 chips and on each turn may bet from 20 to 200 chips.

Stud Poker is for one to four players. Players compete against the computer dealer. There are options to have the first card of either the dealer or player or both dealt face down. After each card is dealt, each player must decide whether to continue his betting or fold. After playing poker for several hours the highest hand we ever got was two pairs—not exactly a game of high thrills. This cartridge will appeal to those with a gambling urge and it will also demonstrate how quickly one can lose real money in Las Vegas or Atlantic City. ☐

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# Mountain Hardware
## SuperTalker

**Steve North**

Mountain Hardware's SuperTalker is a speech input-output board for the Apple computer. It plugs into any I/O slot and connects with an ordinary external speaker and a dynamic microphone (included). The SuperTalker contains the circuitry to convert voice input into binary and to convert binary information back into speech - in effect, your very own digital recording studio (at least conceptually if not in real performance).

The hardware in this case does not need to have an overwhelming amount of intelligence. Its only job is to sample the speech as it is spoken into the microphone, convert it to binary and give it to the computer. The Apple can then manipulate this information in memory or disk files. Likewise, to speak, the SuperTalker transforms binary information back into speech patterns. The SuperTalker does not process individual speech phonemes but arbitrarily records and plays back all the sound input when it is recording.

The quality of the SuperTalker speech is suprisingly good since most computer generated speech is choppy and mechanical. Every word is clear and understandable. The tradeoff is that the SuperTalker requires more software for its operation and more memory for data storage than speech synthesizers which need only a few phonemes to be controlled. Thus a random access disk file is needed to store SuperTalker speech data because of its bulk. The speech can be sampled at four rates from 512 to 4096 bytes/second, and sounds best at high sampling rates though it is still understandable at 512 bytes/second. The hardware can also be programmed at four volume levels.

The SuperTalker software comes on disk and requires 48K of memory and Applesoft in ROM. The disk contains several demonstration programs and utilities: SuperTalker Test allows you to speak into SuperTalker and hear your voice back. Color Math is a math drill with graphics and a friendly voice to help too. Accent is a language learning aid (see separate review). Phrase tables for the demos are stored on the back of the same disk.

Most people writing their own speaking and listening programs will be interested in VPS (Vocal Preparation System), an operating system designed to maintain phrase tables of prerecorded speech on floppy disk with voice entry and editing. Your programs then load the speech tables from disk to drive the SuperTalker. VPS phrase table disks are formatted differently than normal Apple DOS diskettes and VPS has its own high-speed disk drivers to load speech information from disk as quickly as possible.

VPS has several different command modes or levels. At the main level you can manipulate entire phrase tables on the disk, set the sampling rate, volume, or initialize a new disk. At the next level, Edit mode, you can do operations on an individual phrase table. You can list the phrases in a table, have them spoken, append, insert, or delete existing phrases. In lowest level of VPS, Vocal Creation level, you can enter the words associated with the phrase and then speak the phrase into the microphone and both will be saved on disk in a phrase table. (Note that the voice input capability of the SuperTalker is used only for entry of information for computer speech synthesis, and not for speech recognition). VPS commands are all single characters, numbers and control characters to get from one level to another.

The purpose of using VPS is to build phrase tables on disk for your own software. The SuperTalker disk contains two files which help you to use the SuperTalker in custom software: USER.BIN (machine language subroutines) and VPS.TXT, an EXEC file which appends SuperTalker routines in BASIC to your program. A section in the manual describes how to allocate portions of the computer's memory for different system areas and programs, and how to interface your programs with the SuperTalker routines. The subroutine calls provide functions such as loading and saving of phrase tables from disk, listening and speaking one or more phrases and management of phrase tables in memory. Some of these functions make it easier to speak several phrases quickly in sequence. For example, if you want the computer to speak a number, such as "twenty-one," you don't want to hear a large gap between "twenty" and "one."

Obviously, programming a device like the SuperTalker with special subroutines and random access disk files is not for the faint-hearted. The documentation is well-written, but if you don't know much about what's going on inside the Apple then programming the SuperTalker will not be easy at first. This shouldn't discourage you from buying one, but you should be aware that some effort will be required to get the results you want.

Overall, the SuperTalker is an excellent combination of hardware and software. It's one of the best-sounding speech synthesizers we've reviewed.

**Abbreviated Summary of VPS Operating System Commands**

A Set address of phrase table in memory.
B Set default silence behind phrase.
C Catalog of phrase tables
D Delete a phrase table on disk.
E Edit a phrase table.
F Sets default silence in front of phrase.
I Initialize a phrase table diskette.
L List phrases in phrase table.
M Set default length of phrase tables.
O Sets output port number.
Q Quit (reboots DOS)
R Sets sampling rate.
T Talk (lists and speaks phrases).
V Sets volume.

Edit Level Commands

A Append phrases.
D Delete phrases.
I Insert phrases.
L List phrases.
M Sets maximum table length.
R Sets sampling rate.
S Gives statistics on current phrase tables.
T Talk (lists and speaks phrases).
V Sets volume.

cntrl-S Returns to main command level without updating disk.

cntrl-E Returns to main command level and updates disk.

## Creative Computing Visits Mountain Hardware

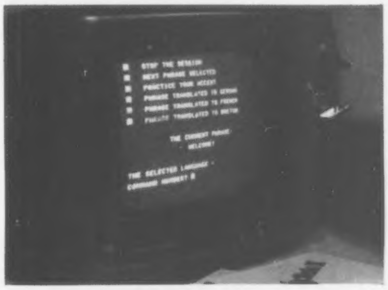
Mountain Hardware, Inc.

Mountain Hardware's new plant is nestled in the foothills of Santa Cruz, California.

SuperTalker requires an Apple with one or two disk drives and Applesoft in ROM. Microphone, speaker, demo disk and manuals are included.

The laboratory and test area was neat and orderly compared to, say, Creative's Software Development Center.

Gary Muhunen, genial president of Mountain Hardware, demonstrated SuperTalker to us on our visit to the plant.



SuperTalker presents the phrase in English. You choose the language into which you want it translated.

A row of 28 Apple real-time clocks getting burned in.

## SuperTalker for Language Instruction

### Betsy Stapes

"Welcome! How are you?" "I'm hungry." "More beer." "Thank you." After an hour of practice with Mountain Hardware's SuperTalker and its ACCENT program, even the most non-language-oriented computer enthusiast should be able to get along in a German Brauhaus.

ACCENT comes with a phrase table containing eleven phrases which it translates into French and German. In addition to those above, the list includes: "It's cold," "It's pretty," "Good luck," "Occupied," "Have a good trip," and "See you soon."

After a brief introductory speech, SuperTalker invites you to begin your language lesson. A phrase appears on the screen and is spoken in English. You may then choose to hear the same phrase in French or German, practice your pronunciation, skip to the next phrase or end the lesson.

The phrase is "Thank you," and you want to learn German, so you press "4." The screen flashes "Vielen Dank," and you hear a voice pronouncing it in German. You may hear it repeated as many times as you wish simply by pressing "4."

When you've heard enough and feel ready to try it yourself, press "3." This time you hear the phrase followed by a silence during which you repeat into the microphone. If you're quick, you can repeat the whole phrase in the allotted time. Now the screen prints "I sound like this," and repeats the phrase. Then, "You sound like this," as it plays back your voice. If you're satisfied, you can go on to another phrase or another language. If not, go back and try again.

As a novelty or a demonstration of computer speech, ACCENT is interesting and entertaining, but I soon became bored with the eleven phrases and began to think of ways the program could be used for serious foreign language instruction. Translation is only a very small part of modern language learning. In today's classroom, the emphasis is on repetition of dialogues and pattern drills. The language lab has become an integral part of the curriculum.

## SuperTalker, con't...

SuperTalker's main advantage over a traditional language lab is its ability to be both audio and visual. After an initial introduction of the chapter dialogue by the teacher, a student could use a modified version of ACCENT to practice reading and pronouncing it. For example, to learn a dialogue beginning with the Spanish phrase, "Hola, Paco," the student would hear the phrase and see it printed on the screen, he or she could press a second key to hear it again, a third to practice pronunciation and a fourth to see the translation. Vocabulary for the chapter could be handled similarly with translations from either language, and a scheme could also be worked out for pattern drills.

Another feature that makes ACCENT attractive as a teaching device is the "practice your accent" option. The student can compare his or her pronunciation with the instructor's without rewinding a tape or otherwise getting involved with the machine's controls.

The program seems to have been quite thoroughly idiot-proofed. The only problem occurred when I accidentally hit the key to end the session. I was immediately presented with a farewell message, and there was no way to go back to the lesson except to re-load the program, re-insert the phrase table and start over.

After spending some time with the phrase table provided with the program, I decided to test my ideas by creating my own phrase table. At this point, frustration set in. ACCENT was apparently not designed to be used by language teachers or others unfamiliar with computers. Our software development staff tried to warn me—"very complicated," they said. But I was—and am—convinced that if the program is to be useful for foreign language instruction, it must be easy for language teachers—most of whom are not familiar with the intricacies of computers—to use.

The first step in making something easy to use is to provide a set of detailed instructions and examples. The SuperTalker Operating Manual has a section entitled, "Creation of a Diskette," and an additional sheet on "Using ACCENT." I read both, plus a few other apparently pertinent sections. They were written in English and did include examples. "Aha!" I thought, "this is going to be simple."

I got off to a good start and succeeded in recording five Spanish phrases. I played them back and noticed that the voice quality was good and the accent reproduced faithfully. Inspired by my success, I decided to go back and edit one phrase to improve the intonation. I followed the instructions for editing, but was then unable to play my phrases again.

After much reading and experimentation, I finally gave up, reloaded the program and recorded the phrases again. This time I couldn't get them to play back at all.

Of course, I'm sure there is a very logical explanation for my failure and an easy remedy for my problems. The point is, however, that I was unable by reading the documentation to find either.

The conclusion: SuperTalker has great potential as a tool for foreign language teaching, but only if the teacher can use it, and the documentation as it now stands is somewhat weak in providing information in a form that the layperson can use effectively. Nevertheless, it's a neat peripheral as long as you can borrow a computer jock to help you learn the ins and outs of the system. ☐

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Most businesses, small or large, have a tendency to buy too much computer for their job. We learned about this with TRS-80 Model I; in fact Model I is too little computer for many business applications. So we designed Model II to be "just enough computer" for most micro/mini applications. And here's a promise: we'll sell you what you need, not less, not more, and you will SAVE MONEY.

### *Does a retailer belong in the business-computer business?*

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# A Computer Driven Real Three-Dimensional Display

### Jon Cohen

There have been applications for three-dimensional imaging for many years, yet most computer graphics display systems have been constrained to present three-dimensional information on two-dimensional screens. Some computer graphics displays augment 3-D images with perspective calculations, depth intensity cueing, movement (such as rocking and spinning), and/or stereo pairs. All these strategies contribute to three-dimensional illusion, but none produce true three-dimensional images. Many schemes for creating real three-dimensional images have been tried. Some involve complicated mechanical devices such as moving screens or mirrors; others, such as staining transparent gelatin, are more exotic. One simple concept easily produces three-dimensional images; this concept is a display system implemented with a varifocal mirror.

A varifocal mirror is a mirror whose focal point changes due to mirror vibration. Mirrors with different curvatures have different focal point positions and thus appear to reflect images at different depths. The curvature of a vibrating mirror changes smoothly from concave to convex and back; therefore, a screen, when viewed through the vibrating mirror, appears to sweep back and forth through a "virtual volume" space behind the mirror (Figure 1). If a dot were displayed continuously on this image presenting screen and if the mirror vibrated at a rate to fuse the reflected image, the reflected dot would occupy the same coordinates on all the reflected screens (which have different virtual depths), then the reflected image would appear to be a line. A circle on the screen becomes a cylinder within the virtual volume.

The resultant virtual image appears real. The most powerful three-dimensional depth cues are present: a viewer can gain different perspectives simply by moving his or her head (this is known as head motion parallax); the viewer has to focus his or her eyes differently for the front or the back of the virtual image (this is known as stereopsis). In fact, the three-dimensionality of the image is so powerful that people who are blind in one eye have no problem sensing the depth of the image.

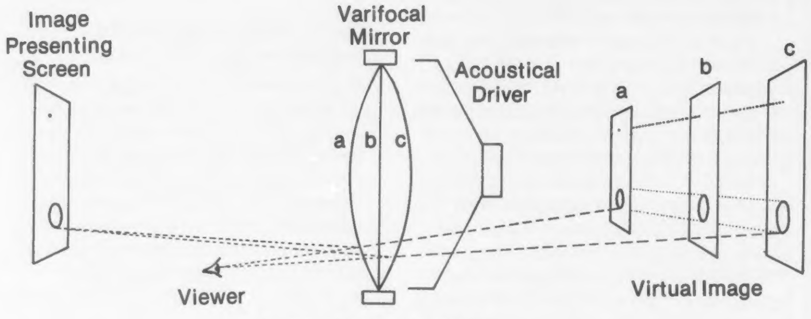

Figure 1: The Varifocal Mirror

At any given moment, the part of the virtual volume that is being "drawn" is the reflection of the image presenting screen. This instant's reflection is often called the "writing plane." The writing plane, therefore, is a cross-section of the virtual image. One could build any three-dimensional image by displaying the associated cross-section of the image to be drawn on the image presenting screen at the appropriate time. As the mirror moves, the writing plane changes depth and a new cross-section must be placed on the image presenting screen. The sequence of cross-sections on the screen builds the virtual image each mirror cycle.

An illustration of this principle is discussed later when examples of varifocal mirror display systems are presented, but first let's examine the components of such a display (Figure 2). The first component is the mirror. The most straightforward construction of a vibrating mirror consists of a thin, reflective substance (such as one mil thick aluminized Mylar) that is stretched on a frame and placed in front of a speaker driven with a low frequency sound (at a rate to produce a fused, non-flickering virtual image, about 30 hz.). Second is an image

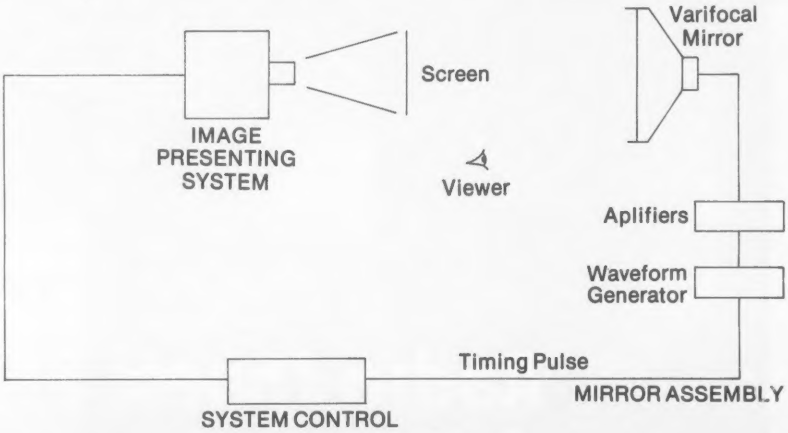

Figure 2: Display System Configuration

---

Jon Cohen, 404 Hillsborough Rd., Carnoro, NC 27510.

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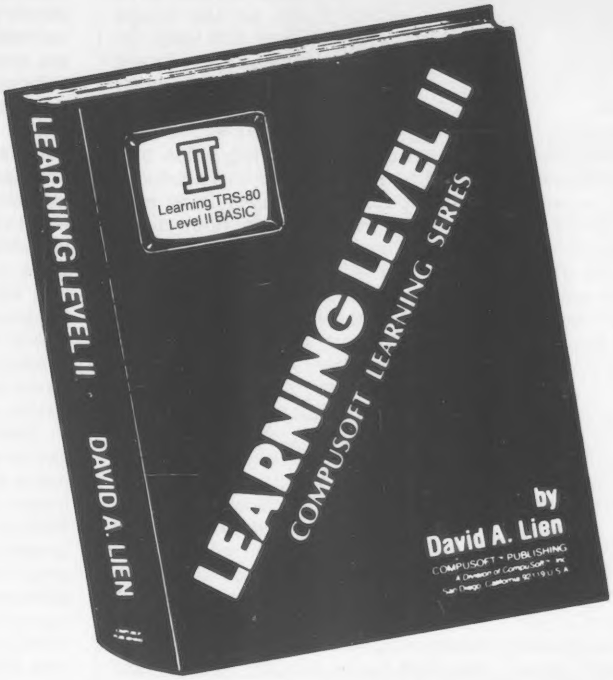
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## Display, con't...

presenting system which may have any of a large number of configurations from a high speed projector to a CRT display. Finally, there is some kind of system control which synchronizes the actions of the other components.

Although other constructions exist, most varifocal mirrors are made out of thin, reflective substances. Some mirrors are mounted between glued pieces of cardboard, others are mounted in embroidery hoops, but specifically designed mounts which provide even surface tension without wrinkling produce the best results. Since most speakers are not designed for low frequency (30 hz.), the mirror driving speaker should be a sturdy woofer. It is expected that the mirror excursion from planar (which determines the mirror's focal point) will follow the speaker's driving waveform's amplitude. (Note that little mirror excursion changes produce large changes in the focal point position). The driving waveform could be chosen for good writing plane movement, but the waveform which causes linear writing plane movement also produces harmonics and noise. The waveform producing minimum noise, the sinewave, produces a writing plane that moves slowly in the front and in the back of the virtual volume.

As mentioned before, the virtual image must be refreshed thirty times a second in order to avoid image flicker. Thus, the image presenting system must be able to present cross-sections at least at a rate equal to thirty times the number of cross-sections. If only one half mirror cycle is used for drawing (as the mirror moves in one direction), this image presenting rate must double. If the writing plane is not moving linearly, then this rate may not be constant during the mirror cycle.

The system control can be as simple as a timing pulse generated by either the image presenting system or the mirror driving assembly and accepted by the other component. The system control could be as complicated as computer control that generates images for presentation and waveforms for the mirror driving assembly. In many displays, the system control could be a real-time microprocessor control program.

Obviously, varifocal mirror display systems have a large range of configurations. Presented now are three examples. The first system, the simplest of the examples, is an imaginary system designed to show the minimum working configuration. The image presenting system is a motion picture projector modified to run at 600 frames per second. The system control would consist of a timing pulse placed on the sound track of a twenty frame film loop. On this loop are arranged ten image cross-sections in order followed by the reverse order of duplicate cross-sections. A hardware waveform generator accepts the timing pulse produced by the projector and produces the waveform that causes linear writing plane movement in both directions. The mirror is thin Mylar stretched over the speaker cone. This display will distribute ten cross-sections within the virtual volume.

This system provides the minimum components of a vari-focal mirror display system and is similar to many early displays. This system is severely limited: the spacing and the number of slices within the virtual volume are constrained. It is also expected that the waveform that causes linear writing plane movement will also produce much noise. Finally, this system does not allow any interactions with the virtual image.

The second system example, which is currently being developed by the author, is similar to the first system but is more flexible. The image presenting system is essentially twenty slide projectors all focused onto a common screen (with optics to correct for any off-center keystone effects). The slide projector bulbs are replaced with Xenon flash tubes that are fired in sequence by a microprocessor system control. Note that there is no constraint behind the time between the firing of successive flash tubes: the microprocessor can order the firings in any order at any time. Thus, the waveform could be chosen for quiet, stable display (the sinewave), and the microprocessor can order the timings of the image presentation to compensate for the non-linear writing plane movement through the virtual volume. Note that any spacing of up to twenty slices within the virtual volume is possible.

The images are photographed and positioned into the slide projectors. The relative depths of each slice within the desired image space (as well as the number of slices) are given to the microprocessor. The micro calculates the time to fire each flash tube and then runs the display by firing the tubes and sending a timing pulse to a hardware sinewave generator each mirror cycle. Two slide-pot inputs will allow the suppression of slices from the front and from the back of the virtual volume.

This system has the advantage of variable slice spacing, interactive slice suppression, variable number of slices (1-20), and quiet operation. It is especially pleasing that the only moving part of the system is the mirror itself. Finally, this display can be modified later, if the flash tubes are replaced with constant illuminations and high speed shutters (under microprocessor control). Then each slice's thickness within the virtual volume can be variable (by controlling the duration of the image's presentation on the screen), even to the point of overlapping, by placing variable intensity illumination devices on each constant illumination and controlling each slice's brightness relative to the other slices. Some slices can be made brighter than others, thus, making the bright cross-sections stand out within the virtual volume.

The final system, built by the author to test theories and designs of the mirror assembly, involves a CRT image presenting system and a PDP-11 system control. With high speed projector, one can expect to show only a couple of tens of cross-sections (even though the cross-sections can be arbitrarily complex), but if the cross-sections are simple lines and dots (i.e., the cross-sections of three-dimensional vector drawings), then vector graphics displays are capable of presenting many hundreds or thousands of cross-sections. Figure 3 shows this display in operation.

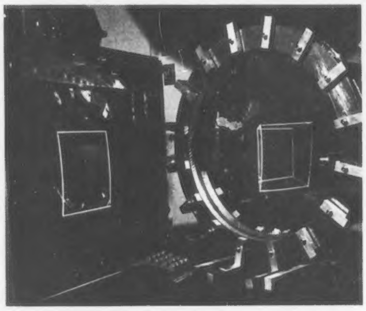


Figure 3: CRT Varifocal Mirror Display

The image that is drawn on the CRT screen consists of a square, followed by a series of cross-sections of dots at the square's corners, followed by another square on top of the first one (the face marks of each square are drawn at the same time as the squares). The CRT image is drawn above the flicker rate, thus the resultant CRT image appears to be a square, but since the image changes in time, the virtual image is a cube.

It should be noted that the CRT is drawing images only three percent of the time, the rest of the time is spent moving a turned off beam back and

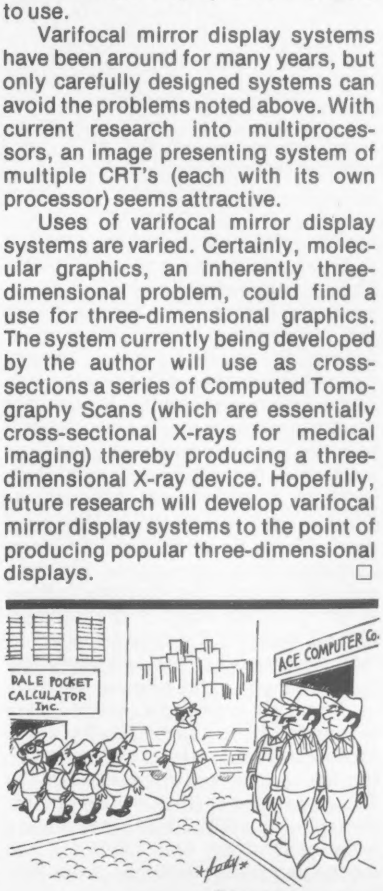
## Display, con't...

forth to wait for the mirror to move. Thus, using the same configuration as shown, much more complex images can be drawn.

Varifocal mirror display systems do have a few technical problems. Since the time of image presentation is related to the depth within the virtual volume, it is difficult to move (or rotate) the virtual image. When parts of the image change their Z coordinate, the order of image presentation may change. Another problem is that it is difficult to present complex images at high speeds. Also, there is a problem in that mirrors with different curvatures magnify the reflected image by different amounts, thus the virtual volume seems to become bigger towards the back (this distortion is often referred to as "anomalous perspective"). The amount of this distortion is known, thus cross-sections that are to occupy the rear of the virtual image can be pre-shrunk to correct for this variable magnification with depth. Finally, many mirror driving assemblies produce a large amount of noise and make the display uncomfortable to use.

Varifocal mirror display systems have been around for many years, but only carefully designed systems can avoid the problems noted above. With current research into multiprocessors, an image presenting system of multiple CRT's (each with its own processor) seems attractive.

Uses of varifocal mirror display systems are varied. Certainly, molecular graphics, an inherently three-dimensional problem, could find a use for three-dimensional graphics. The system currently being developed by the author will use as cross-sections a series of Computed Tomography Scans (which are essentially cross-sectional X-rays for medical imaging) thereby producing a three-dimensional X-ray device. Hopefully, future research will develop varifocal mirror display systems to the point of producing popular three-dimensional displays. ☐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# Battle Of The Word Processors

### Rod Hallen

The terms "text editor" and "word processor" are often used interchangeably but what are they and what do they do? A text editor is used to compose a group of characters, words, sentences and paragraphs so that they can be used to print letters, articles or books. In most cases this type of text editor can also be used to generate the source listing for an assembler or BASIC interpreter.

A word processor uses the output of the text editor as input. The word processor then formats the text file for hardcopy printing. This includes headings, margins, line length, page numbering and much more.

Digital Research's ED and TEX are designed to be used with each other. ED creates a text file and TEX formats and prints it. TSC's EDIT and PR work together in a similar manner. Michael Shrayer's Electric Pencil combines both functions in one program.

```
Text Editing System - ED
     Comes as a component of the CP/M DOS
Word Processing System - TEX  $75

From: Digital Research
      P. O. Box  579
      Pacific Grove, CA 93950

- - - - - - - - - - - - - - - - - - -

Text Editing System - EDIT  $40
Word Processing System - PR  $50

From: Technical Systems Consultants
      P. O. Box  2574
      W. Layfayette, IN  47906

- - - - - - - - - - - - - - - - - - -

Text and Word Processing System
- Electric Pencil II  $250

From: Michael Shreyer Software
      1253 Vista Superba Drive
      Glendale, CA  91205
```

Table 1. This is a source and price list. There are a great many versions of each of these programs available. Contact the software houses listed for more information.

> **I have always had trouble following Digital Research's documentation but if you read a little, try it out a little, read a little, and try it some more, you'll get the picture after awhile.**

Basically, we'll compare ED with EDIT in Part 1 of this article and TEX with PR in Part 2. And, I'll throw in some comments about the Electric Pencil (EP) from time to time. Both TSC and Shrayer provide many versions of their programs for various system configurations, but we'll be discussing the standard CP/M disk versions.

## ED From Digital Research

When you buy the CP/M DOS, you get ED as part of the package. I have been using ED for about 9 months and by now I am fairly familiar with it. ED isn't normally used to generate text files and I usually use it to generate assembly language source listings for input to the CP/M assembler.

ED is supplied with a sixteen page manual which is sufficient and all of the required information is to be found in it. I have always had trouble following Digital Research's documentation but if you read a little, try it out a little, read a little, and try it some more, you'll get the picture after awhile.

ED allows you to create a new text file or to revise an existing one. Upon entry you must specify a file name. If the specified file does not exist on the disk, then ED will open a new file with that name and type and allow you to enter text into it.

Creating a text file with ED consists of entering characters into a memory character buffer. The capacity of this buffer is determined by the size of your CP/M system with the 16K version holding about 6000 characters. This is not, however, a limitation on the size of the text file that you can create and manipulate. The only limitation is the disk space available. In fact, since ED can get its input from one disk drive and send its output to another, it is literally possible to write and revise a text file of almost a quarter million bytes.

ED will bring in a portion of the text file from the disk, allow you to study and, if required, revise it, then put it in a new file on the same or another disk and bring the next portion in to be worked on. This can continue until the entire file has passed through the memory buffer. When finished editing, the original file will have its file type changed to BAK and the new file will carry the name and type of the original file.

If you are creating a new file, text is typed until you get a "Buffer Full" message. You can then dump part of the file to disk and continue typing. This goes on until the file is complete. I am running a 52K CP/M system and I have never seen the "Buffer Full" message while creating assembly language source listings.

---

Rod Hallen, P.O. Box 73, Tombstone, AZ 85638.

## Word Processors, con't...

ED is a line-oriented editor. Each line, which can be longer than a screen line, is terminated with a carriage return. In order to make it easier to identify lines for the purpose of making additions, deletions and corrections; each line is assigned a number internally (the line numbers are not displayed on the screen). This numbering system is on the order of a BASIC program except that it is automatic. Deleting or adding a line will cause all of the following line numbers to decrease or increase accordingly. The numbers are for reference only and they are not stored in the disk file or printed when the file is listed.

Basic to the operation of ED is the concept of an imaginary character pointer called a cp. All additions, deletions and changes are referenced to the cp. If you want to remove a five letter word, you move the cp to the beginning of the word and issue a 5D Command (delete 5 characters). If you want to insert a word, you move the cp to the desired location and issue an I (insert) Command. You can then enter continuous text until you terminate Insert with a Control 2.

This sounds quite simple and yet it constitutes my major complaint against ED. Such a strong complaint that I am no longer using ED at all! My problem arises from the imaginary nature of the character and line pointers. There isn't any indication on the screen of the location of the cp and you have to try to remain constantly aware of its current position. I find this extremely difficult to do.

Consider the following telephone conversation:

Near End, "Read me line 6."
Far End, "The quick brown fox jumped over the lazy dog's back."
NE, "Well he's not really lazy. Delete word 9 and read the line to me again."
FE, "The quick brown fox jumped over the lazy back."
NE, "Wrong word! Delete word 8, insert /dog's/ in its place, and read 6 again."
FE, "The quick brown fox jumped over the dog's back."
NE, "O.K. Next line."

That's the way ED strikes me. It was designed for use with a serial terminal and not a memory mapped video screen. Contrast this to the Electric Pencil which keeps a cursor on the screen at all times to indicate the current work location. Four cursor move keys (Control characters) are used to move the cursor to the desired location. You then make the necessary changes and they take place right before your eyes.

As an analogy to the above telephone conversation, I'd describe the Electric Pencil method of correction thus: The sentence, "The quick brown fox, etc.," is written on a piece of paper in pencil. To delete 'lazy' you erase it. The result is immediately apparent. No counting, indexing or guessing is required.

So far I haven't even scratched the surface in covering the capabilities of ED. It has many useful features, some of which help to compensate for the ambiguity of the imaginary cp. Search and replace is one example. This can be used to find and replace a character string any number of times in the text file. It will even search the portion of the disk file that has not yet been brought into the buffer.

**One drawback to the Electric Pencil is the requirement that the entire text file must fit into memory while it is being worked on.**

One feature of ED that I wish Pencil had is the ability to report on the buffer size and the amount of memory in it that is free for use. One drawback to the Electric Pencil is the requirement that the entire text file must fit into memory while it is being worked on. This means that a large file must be broken down into parts with each part having a different name.

I especially like ED's library file capabilities. A block of text which will be used frequently can be written into a text file with the type LIB. This can then be called up and inserted into any other file which is passing through the text buffer. You can also create a temporary work file to hold a block of text which can then be used as many times as necessary while creating or revising a file. Editing Commands can be issued in strings as well as one at a time. #AV22T would load the file into the buffer, turn on line numbering and print the first 22 lines of the file. 15:2KI would go to line 15, Kill (delete) 2 lines and then enter the Insert mode.

There are a great number of other Commands available and I won't go into any detailed description of them all here but you quickly memorize the dozen or so that are used most often. A Command summary card is provided to help in this regard.

This review of ED has been necessarily brief, but I think I have covered its major points. After I describe TSC's EDIT in the following section, I'll give my personal recommendation on their relative worth, colored by my Electric Pencil prejudice, of course.

### EDIT From Technical Systems Consultants

EDIT contains most of the features of ED and a lot more. The first thing I noticed while glancing through EDIT's extensive documentation is a complete assembly language source listing. Since I like to change commercial software to meet my own requirements and desires, a listing such as this is immensely helpful. I only wish that they had also copied the source onto the system disk; I can't see myself typing in all 74 pages of mnemonics by hand.

On top of the flexibility the source listing provides, many internal parameters can be changed with the SET Command. As an example: the character delete code is 08H which is Control H or backspace. You can change this to rubout or any other code that suits you.

Files written with ED are acceptable to EDIT and vice-versa and either can write source files for the CP/M assembler. Electric Pencil files are not compatible with any of these and I'll discuss a solution to that problem at the end of Part 2 of this article.

EDIT is line oriented with a slightly different method of handling the line numbers. If you wanted to insert a new line between existing lines 5 and 6, you'd type "5.5I" and would enter the Insert mode at line 5.5. Issuing a REN Command will renumber the file from the beginning by 1's (i.e., 1, 2, 3, 4, etc.). The # is used as the prompt. Whenever it is the first character on a new line, the system is looking for a Command. Commands, by the way, are called Directives by EDIT. Directives can be entered individually or as a string of Commands separated by a $.

**Files written with ED are acceptable to EDIT and vice-versa and either can write source files for the CP/M assembler.**

Directives are normally preceded by a line number to identify the line to be worked on. If a line number is not specified, then the Directive defaults to the current line. The current line concept corresponds somewhat to ED's cp. You can find out at any time what the current line is by entering a carriage return immediately following the # prompt. Lines can also be identified by entering +n or -n ahead of a Directive with n equal to a given number of lines after or before the

## Word Processors, con't...

current line. ! means the first line of the file buffer and ! means the last. And finally, you can identify a line by describing a string contained within it. #/John/P will find the first line after the current line which contains the string "John," make it the current line, and print it on the screen. #-/John/P will search backwards from the current line.

EDIT handles tabs differently than either ED or Pencil. The latter two are set up with tab stops every 8 spaces starting from the left margin. EDIT allows you to set tabs anywhere in a line that you like. To make it easier to determine the character space number at which you wish to place each tab, a Header Directive puts a line of numbers across the screen which correspond to the character space numbers.

The method of making corrections within a line reminds me of the Microsoft BASIC editor. A line number and an Overlay Directive are entered and the editor prints the desired line on the screen with the cursor beneath it. You move the cursor with the space bar to the location in the line at which you want to change one or more characters and then type the correct characters. You can also add to the end of a line in this manner. This is still a little like remote control editing, but it is a step up from ED.

**I have often wished there were some easy way to combine the best features of many different word processing systems into one "Super" system.**

Deleting a character or characters from a line can be accomplished using the Change Directive. "6C /apple/apple/" will replace the first string with the second string in line 6. It would be much better if there were a delete key code such as Control H or backspace for deleting characters while in the Overlay mode.

Search and Replace works in a manner similar to ED with the addition of many powerful features. The search can be limited to a restricted number of vertical columns. A Controlled Search and Replace will allow selective changes. With the feature you specify an old and a new string and EDIT will search the file for the old string. Each time it is found, the line containing it will be printed on the screen and you will be asked if you want the old string replaced with the new. After you reply, the next occurance will be printed and the question will be asked again. This will continue until the entire buffer either forward or backwards has been searched. EDIT cannot search any part of a file that is not in the memory buffer as ED does.

| ED | EDIT |
|---|---|
| Search disk | Easier corrections |
| Buffer SIZE/FREE | Controlled search |
| Library capabilities | Source listing |
| Temp work files | Documentation |
| | Flexible codes |
| | Flexible Tab stops |
| | Loads multiple files |

**Electric Pencil**

Screen oriented editing
Scrolling
Visible, movable cursor
Disk directory
Word count
Documentation
Loads multiple files

Table 2. These are what I consider to be the best features of each of the text editors. This does not include the Electric Pencil's Word Processing capabilities which will be covered in part 2.

A Repeat function (Control B) makes for less typing of Directives than would ordinarily be required. !P15 will print the first 15 lines of the buffer on the screen. Each time Control B is typed another 15 lines will be displayed. Enter a new Command string and Control B will repeat the new one until it is changed.

There are many more Directives than I have described here. The Command Summary sheet lists more than 30.

### ED Versus EDIT

Table 2 lists what I consider to be the best features of ED, EDIT and the Electric Pencil. While this is a subjective selection, it was arrived at by deciding which features I would incorporate into a text editor if I were writing my own. In fact, I have often wished there were some easy way to combine the best features of many different word processing systems into one "Super" system.

When trying to decide which is the best system, three different areas of judgement come into play. These are: what features does it have, how easy is it to learn and use, and how much does it cost?

Since I am assuming that you already have the CP/M DOS, I'll have to put ED's cost at zero which gives it the advantage in that area. The rest isn't so easy to judge.

Disregarding the cost difference between the two, I'd have to pick TSC's EDIT. It is a much more powerful editor and I feel it is easier to use. Your final judgement would probably hinge on how often you have need of a text editor. For occasional use I think that ED would suffice. By the same token, for those of you who do a great deal of word processing, in my opinion, the Electric Pencil is the best answer.

Have I ended up confusing you? I hope not. This project turned out to be more difficult than I imagined. Trying to learn and keep straight in my mind three different sets of Commands, conventions and procedures at the same time has proven to be almost too much to handle.

Of course, the fact that there is more than one word processor available means the buyer has a choice. Just as he has a choice between Chevrolets and Cadillacs, Peugeots and Porsches. In the long run the marketplace will weed out the totally unacceptable products and those left will each fill some niche.

In Part 2 of this review I'll look at TEX and PR and then try to end up with a cost effective overall system. ☐

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# Computer Aided Manufacturing Part I: Automating The Production Process

### Chuck Carpenter

Computers may be a major factor in determining if a manufacturer will be in business several years from now. Productivity improvements by monitoring all critical aspects of production, timely and dynamic management information, product scheduling to prevent conflicts and virtual elimination of paperwork drudgery are but a small sample of the potential benefits from computers. And, even for the small business, many of today's personal computers can be put on-line for less than the salary of one employee. Cost savings can be 10 times (or more) of the cost when factored against increased operating efficiency, reduced production costs and increased profits. Let's examine some of the functions, activities and tasks that are part of manufacturing production operations. Let's see where computers can be used and the benefits that are possible.

## Manufacturing Operations Environment

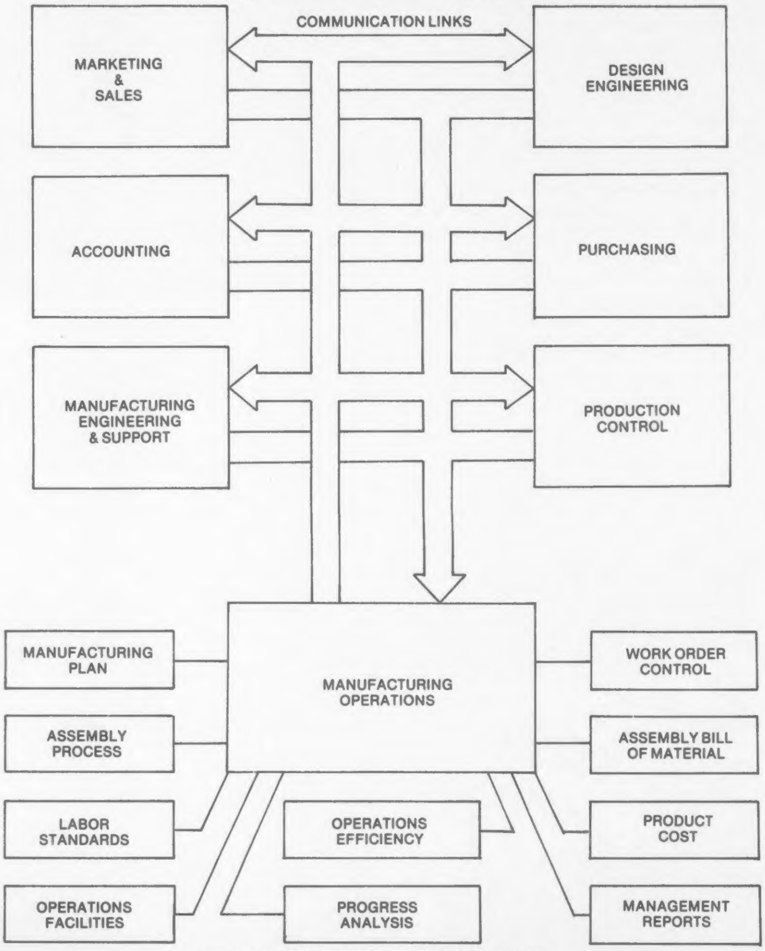
Figure 1 illustrates a typical manufacturing organization. The functional relationships of manufacturing operations to the rest of the organization provides the foundation and support for the existence of the total organization. The net result of all other tasks ends up with the product. Sale of the product and the anticipated profit is the ultimate goal.

Unless the manufacturing of the product is made as efficient as it can be, competitive pricing may not be possible and anticipated profits will not be realized. That's where Computer Aided Manufacturing (CAM) comes in. Automating the manufacturing operations system will (with a large measure of good judgment) provide the timely and dynamic management information needed to make better decisions.

## A Place to Start

Many articles have been written about automated (or computer controlled) operating systems for businesses of all sizes. But most of them have been accounting systems: Systems for the general ledger, personnel and payroll, billing systems and any number of tasks needed to provide a labor-free record of your financial activities. All these accounting activities occur after the fact. Any problem that shows up in a periodic financial report has already hap-

MANUFACTURING FUNCTIONAL RELATIONSHIPS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MANUFACTURING OPERATIONS
WORK ORDER CONTROL
ASSEMBLY PROCESS
ASSEMBLY BILL OF MATERIAL
LABOR STANDARDS
OPERATIONS EFFICIENCY
PRODUCT COST
OPERATIONS FACILITIES
PROGRESS ANALYSIS
MANAGEMENT REPORTS

OPERATIONS DATA BASE — DATA BASE INTEGRITY

Figure 1.

---

Chuck Carpenter, 2228 Montclair Place, Carrollton, TX 75006.

# Manufacturing, con't...

pened. This fact doesn't change much even with computer controlled systems. The input that generates financial reports is, by its very nature, historical (hysterical, too, sometimes).

This article will not be about accounting techniques used in a small business. It will be about the present and future, computer aided planning, implementation and control of manufacturing operations systems. And, to illustrate some of the CAM concepts, I have included program examples. These programs are of a utility nature (written for the Apple II personal computing system), but will demonstrate the power of the computer for automating and increasing production efficiency. Listing 1 shows an example of possible CAM system program options. Remember: it is not my intention to make this article a CAM cookbook. The intent is to provide guidelines and thought stimulation for the development of a CAM system to fit your environment.

```
**** COMPUTER AIDED MANUFACTURING ****


MANUFACTURING OPERATIONS
PLANNING AND CONTROL


LIST OF FILES AND REPORTS

  1. MASTER TASK PLAN
  2. PROGRESS CURVES
  3. MANUFACTURING OPERATIONS
  4. OPERATIONS PRODUCTIVITY
  5. MANAGEMENT SUMMARY
  0. ENDS THE PROGRAM


WHICH ONE DO YOU WANT - 3


TODAYS DATE - 05/05/79

 **** MANUFACTURING OPERATIONS ****

PROGRAM OPTIONS

  1. BILL OF MATERIALS
  2. ASSEMBLY INSTRUCTIONS
  3. LABOR STANDARDS
  4. COST ESTIMATE
  5. MANPOWER ESTIMATE
  0. ENDS THE PROGRAM


WHICH ONE DO YOU WANT - 1
```

Listing 1. CAM System Program Options.

## Background and Caveats

Manufacturing Engineering (or Industrial Engineering as the profession is also known) has been my career choice for the past 15+ years. During that time I have applied the principles outlined in this article in large and small businesses. Some of that time was spent getting a small business of my own started up. Therefore, I have had ample opportunity to consider, develop and implement each of the concepts discussed. (None are text book applications, even though the stimulation for solution of problems resulted from concepts presented in text books). And during that time I was aware of the need to handle more and more data quickly and efficiently.

Productivity in particular must not be allowed to suffer from pre-renaissance technological ignorance on the part of management. Nor can the closely related pencil and paper, data and information transfer situation be tolerated. Very few (and I'm being benevolent) modern business environments can be profitable if these conditions exist and are allowed to continue.

However, having a "Big Computer" system may not help management even if the desire to be productive is there. Many and varied business computer systems are currently available, providing the business with large scale financial management and automated operating systems. But all are very rigid in application. Very little personal interaction is allowed or provided (or intended). All have elaborate operating systems and redundant processing to virtually eliminate processing errors. And it is all very necessary. (What business can tolerate errors in the transaction of daily activities that are the life-blood of success or failure [and of course, loss of profit]?) With all this power though, the progressive manager still has no way to handle large amounts of information for his personal decision making benefit. Furthermore, the reports from such systems are often as historical and after-the-fact as financial data.

Personal Computers provide a powerful low-cost opportunity for a tool to enhance real-time management decision making. (These versatile little computers can be used anyplace where garbaged or lost data will not prevent continuation of the business.) I am committed to find ways to use personal computers as just such a tool.

## But I'm too small for this

You may be looking at the chart in Figure 1 and thinking that a number of these functions don't exist in your manufacturing environment. But they do. The tasks involved may be handled by a few people or only one or two people. If you think about it though, you will recognize that each of these functions is included in your operating environment. Some will be independent and stand by themselves as operating departments. Some will be included with a number of related activities. You may even have some I didn't list. (Not intended to be an oversight on my part—I only included those I considered most common).

A point to consider: You may not need or want to automate everything mentioned in this article. But consideration should be made to account for all functions in one form or another (modified to fit the personality and requirements of your particular operating environment). To say you are a small company and that you don't need to account for these things may be inviting an early retirement.

To account for as many activities as are pertinent is good open-minded management. You may be including several tasks and activities under one responsibility, but none of them should be ignored. Remember that it is often much easier to control the fixed and variable overhead costs in a small company. Knowing this, the progressive open-minded manager has possibilities for imaginative profit-oriented decisions limited only by existing resources. Computer Aided Manufacturing has the potential for extending the existing resources.

## CAM — What is it?

There are many possibilities and variations that have been used to describe Computer Aided Manufacturing. In large companies where there is a substantial capital and expense budget, CAM may mean extensive computer systems and a large supporting staff. Complete inventory systems, manufacturing analysis, sales analysis, product flow and mix, operating efficiency and a whole battery of statistical evaluations will be included in the repertoire of the computer system. I've seen a few games and calendars show up on a terminal from time to time, too (everyone needs a little diversion once in a while).

In small businesses where a number of tasks are performed by one or two (or maybe a very few) people, CAM can have the same sophisticated implementation. Every capability (to my knowledge) available to large CAM systems is available to the small company. This, of course, is with thanks to the availability of personal computing systems.

You may choose to hire programming consultants (at a typical cost of $20 to $35 per hour) or you may have the experience to do it yourself. Either way you can expect the job to take a lot of time. The utility programs

## Manufacturing, con't...

included with this article took about 0.5 hour average per program line to program and debug. I don't claim any special talent as a programmer; but these are short programs, and I knew what I wanted to accomplish when I started.

> Computer Aided Manufacturing: An automated system provided for the planning, implementation and control of manufacturing operations functions that normally require extensive manual input and interaction.

The whole idea then is to develop a tool to make the management job easier, not to implement a system that will make the job of management automatic.

You will have to make the final decisions based on sound judgment and available facts. CAM can make more facts available on a more timely basis. The result will be better decisions and more profit.

### Automation or Manual

Let's digress for a moment and consider a chapter of the book "Up The Organization" by Robert Townsend. Mr. Townsend, as president of Avis, brought the company from near financial disaster to the second largest auto rental company in just a few months. The entire book is worth reading, but the chapter of interest here is titled "Computers and Their Priests." Here's a summary of the points made:

> Make sure the effort expended is directed toward useful documentation and reports. Don't let the ease of report generation become an activity trap.
>
> Be sure that your manual system is effective before trying to automate it. Otherwise your mistakes will show up faster.
>
> You may want to hire a consulting firm to do your programming. If so, make sure your contract states the time and dollar targets. Also, the break-in time so you can find and correct any bugs.
>
> Especially make sure the programmers are willing to live in your shop. If they try to convince you they can write programs for **your** business sitting in **their** office, look for someone else.
>
> Don't do away with your working manual system until the automated system is fully debugged and operational to your satisfaction. You're less likely to suffer from financial disaster from automating too slowly than by going too fast.

The second, fourth and fifth points are applicable to CAM in a small company. The others are good mental stimulators (food for thought). Automation will definitely save money over a slower manual system, but make haste slowly (sic) during development and implementation.

Even with maximum automation of a system, there will still be some paper work. Zero paper work is a noble goal and the direction I would choose to go. but there will still be a need for manually generated input documents. These forms should be designed to organize the data for most efficient entry into the automatic system. The details however, the files and reports, can come from a bulk storage data base and RAM memory associated with your microcomputer system. Let's keep in mind though, that your manual system must effectively support any implemented automation.

### Operations Data Base

We're ready to develop the data base for manufacturing operations. Marketing forecasts have indicated a need for a product. The product will need to be available in quantities, over some period of time, to meet the demand. This demand will rise, stabilize and fall over the life of the product. Engineering concepts are complete, and product descriptions and Bills of Material are now available. Several related product development activities are going on concurrently. On our chart in Figure 1, a number of activities and functions were identified. The ones outside the dotted box are important and will be discussed according to their interactions with Manufacturing Operations. Those within the dotted box will be our main concern for the remainder of this article. Included are the following functions:

Manufacturing Plan
Assembly Bill of Material
Assembly Processes
Labor Standards
Operations Efficiency
Product Cost
Management Reports

These categories will make up the operating data base. From this base, we will develop our computer aided operating system and establish data base integity. Accuracy here is critical to the effectiveness of the total project.

### The Manufacturing Plan

Figure 2 is an outline of a Manufacturing Operations Plan. From this outline will be developed the specific manufacturing plan. Computerizing this plan will allow any variables occuring in the data base to be part of the plan automatically. Changes to the data base show up as changes in the plan automatically. Further manual effort (i.e., to type up a new plan) is not necessary.

Activities and tasks included in the Manufacturing plan are, by their nature, interrelated. Anything that happens in one area will have some effect, more or less, on the others. As you develop your CAM system, special attention will be required to ensure that all interactions are identified and controlled. Let's examine a brief description of each item in the Manufacturing Operations Plan.

Manufacturing Operations Plan
(MOP)

Master Task Plan
Outline

Product Life Plan (Product Description)
Production Volumes and Build Plan
Program Spending
  - Capital Equipment and Tooling
  - Supplier Equipment and Tooling
  - Production Machinery and Equipment (M&E)
Production Facilities
Production Build Schedule
Manufacturing Bill of Material
Production Assembly Instructions
  - Work Station Development
  - Labor Standards
  - Product Cost Estimate
Manpower Planning
Packaging and Shipping
Progress and Efficiency (Manufacturability)
Quality Plan
Reports and Controls

Figure 2.

### Users of The Data Base

Product Life Plan - This section provides a brief (executive) overview of the targets and goals expected of the product. Technical overviews are included and design goals are described (for the benefit of the non-design reader). A more detailed development of the product build cycle is presented here also. The life plan would include total product life expectancy as required to meet the profit goals over the life of the product. Start-up costs, support costs and end-of-product life costs would be included in the life-of-product considerations. More on this later when we come to Progress Curve applications.

Production Volumes & Build Plan - Having provided the executive overview of the manufacturing plan, we need to get more specific. The cash

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| 8080A-4MHz | 19.95 |
| SALE 8085 | 19.95 |
| 8008-1 | 14.95 |
| 2901 | 12.95 |
| 2901A | 19.95 |
| TMS 9900JL | 49.95 |
| CP1600 | 39.95 |
| 6502 | 11.50 |
| 6502A | 19.95 |
| IM6100 | 29.95 |
| 6800 | 13.95 |
| 6802P | 24.95 |
| 8035 | 19.95 |
| 8755 | 49.95 |
| 8748 | 69.95 |
| 6809 | $ CALL |
| 8086 | $ CALL |

### SUPPORT DEVICES

| | |
|---|---|
| AM9511 Arith Processor | $195.00 |
| AM 9511-1 300 ns | 245.00 |
| AM9517 DMA Controller | 71.95 |
| AM9519 Universal Interrupt | 24.95 |
| 3881 (Z80 PIO) | 9.95 |
| 3881-4 (4MHz) | 14.95 |
| 3882 (Z-80 CTC) | 9.95 |
| 3882-4 (4MHz) | 14.95 |
| 3883 SIO | 29.95 |
| 3884 DMA | 49.95 |
| 8205/74S138 Decoder | 2.95 |
| 8212 8 bit I/O | 2.50 |
| 8214 Priority Int. | 4.50 |
| 8216 Bus Driver | 2.50 |
| 8224 Clock Gen. | 2.95 |
| 8224-4 (4MHz) | 9.75 |
| 8226 Bus Driver | 3.95 |
| 8T26 Bus Driver | 2.39 |
| 8228 Sys. Control | 5.95 |
| 8238 Sys. Cont | 6.25 |
| 8251 Prog. I/O | 6.95 |
| 8253 Int. Timer | 19.50 |
| 8255 Prog. I/O | 5.95 |
| 8257 Prog. DMA | 17.95 |
| 8259 Prog. Int | 17.95 |
| 8275 CRT Controller | 49.95 |
| 8279 Prog. Keyboard | 16.95 |
| 6810-1 128 x 8 RAM | 4.75 |
| 6820 PIA | 5.95 |
| 6821 PIA | 6.50 |
| 6828 Priority Int | 8.95 |
| 6834-1 512 x 8 Eprom | 12.95 |
| 6850 ACIA | 5.95 |
| 6852 Serial Adapter | 5.95 |
| 6845/HD46505 CRT Contr. | 39.95 |
| 6860 Modem | 8.95 |
| 6862 Modulator | 11.95 |
| 6871A 1.0MHz OSC | 25.95 |
| 6875 | 8.25 |
| 6880 Bus Driver | 2.39 |
| MC68488 | 19.95 |
| 1821 SCD 1K RAM | 25.00 |
| 1822 SCD 256 x 4 RAM | 16.95 |
| 1824 CD 32 x 8 RAM | 9.95 |
| 1852 CD 8 bit I/O | 10.95 |
| 1854 Uart | 10.95 |
| 1856 CD I/O | 8.95 |
| 1857 CD I/O | 8.95 |
| 6520 PIA | 7.50 |
| 6522 Mult. | 9.25 |
| 6530-002 | 15.50 |
| 6530-003 | 15.50 |
| 6530-004 | 15.50 |
| 6530-005 | 15.50 |

### DYNAMIC RAMS

| | |
|---|---|
| 416/4116 16K (16 Pin) | 9.95 |
| Set of 8 416's | 74.95 |
| 4115 8K (16 Pin) | 6.95 |
| 4050 4K x 1 (18 Pin) | 4.25 |
| 4060 4K x 1 (22 Pin) | 4.95 |
| 4096 4K x 1 (16 Pin) | 3.95 |
| 2104 4K x 1 (16 Pin) | 4.75 |
| 4027 4K x 1 (16 Pin) | 4.95 |

| | | | |
|---|---|---|---|
| 5261 | 1.95 | 1103 | 1.95 |
| 5262 | 1.95 | 4008L | 4.95 |
| 5270 | 4.95 | 6605 | 7.95 |
| 5280 | 4.95 | 6604 | 4.95 |
| 5290 | 12.45 | 6002 | 1.50 |

### PROMS

| | |
|---|---|
| 2708 | 9.95 |
| 2708-6 | 7.50 |
| 1702A | 3.95 |
| 2732 | 99.00 |
| 2716-5V | 44.95 |
| 2716-5V, 12V | 29.95 |
| 2758 5V | 29.95 |
| 5203AQ | 11.95 |
| 5204AQ | 9.95 |
| 6834-1 | 12.95 |
| IM 5610 | 2.95 |
| **SALE 8223 32 x 8** | **2.95** |
| 82S115 512 x 8 (TS) | 16.95 |
| 82S123 32 x 8 | 2.50 |
| 82S126 256 x 4 | 3.50 |
| 82S129 256 x 4 (TS) | 3.50 |
| 82S130 512 x 4 (OC) | 6.50 |
| NSC DM7578 32 x 8 | 2.95 |

### CHARACTER GEN

| | |
|---|---|
| 2513-001 (5V) Upper | 9.50 |
| 2513-005 (5V) Lower | 10.95 |
| 2513-ADM3 (5V) Lower | 14.95 |
| MCM6571 | 10.75 |
| MCM6571A | 10.75 |
| MCM6574 | 14.50 |
| MCM6575 | 14.50 |

### UARTS/USRTS

| | |
|---|---|
| TR1602B (5V, 12V) | 3.95 |
| AY51013 (5V, 12V) | 4.95 |
| AY51014A/1612 (5-14V) | 6.95 |
| AY51015A/1863 (5V) | 6.95 |
| TMS 6011 (5V, 12V) | 5.50 |
| IM6402 | 7.95 |
| IM6403 | 8.95 |
| 2350 USRT | 9.95 |
| 1671B Astros | 24.95 |
| **SALE TR1472B** | **9.95** |

### BAUD RATE GEN

| | |
|---|---|
| MC14411 | 11.95 |
| 4702 | 14.95 |
| WD1941 | 9.95 |

### KEYBOARD ENCODERS

| | |
|---|---|
| AY5-2376 | 13.75 |
| AY5-3600 | 13.75 |
| HD0165 | 9.95 |
| 74C922 | 9.95 |
| 74C923 | 9.95 |

### A/D CONVERTERS

| | |
|---|---|
| 8700 8 bit Binary | 13.50 |
| 8701 10 bit Binary | 22.00 |
| 8703 8 bit TS | 13.50 |
| 9400 Volt to Freq. Conv | 7.25 |
| 8750 3-1/2 Digit BCD | 13.95 |
| 1408L6 6 bit | 3.95 |
| 1408L8 8 bit | 5.95 |
| DACOI A/D | 5.95 |

### STATIC RAM HEADQUARTERS

| | 1-24 | 25-99 | 100 |
|---|---|---|---|
| 21L02 450ns. | 1.30 | 1.25 | 1.15 |
| 21L02 250ns. | 1.59 | 1.55 | 1.45 |
| 2102 | 1.25 | 1.15 | 1.10 |
| 2111 | 3.75 | 3.65 | 3.55 |
| 2112-1 | 2.95 | 2.85 | 2.65 |
| 2101-1 | 2.90 | 2.70 | 2.55 |
| 2114L-250ns. | 12.95 | 10.95 | 9.95 |
| 2114L-300ns. | 8.95 | 7.95 | 6.45 |
| **2114L-450ns.** | 7.50 | 6.75 | **4.75** |
| 4044/4041 300ns. | 9.95 | 8.75 | 7.95 |
| **4044/4041 450ns.** | 7.50 | 6.75 | **4.75** |
| EMM4200A | 9.75 | 8.75 | 7.95 |
| EMM4402 | 7.95 | 7.25 | 6.25 |
| EMM4804 | 12.50 | 11.50 | 9.95 |
| 5101C-E | 7.95 | 7.95 | 7.25 |
| upd410 (4200) | 10.95 | 10.25 | 9.25 |
| AMD9140/41 | 10.95 | 10.25 | 9.25 |
| AMD9130/31 | 12.95 | 11.95 | 10.25 |
| FSC 460/46416K CCD Only $18.95 Each | | | |
| 1101 | 1.95 | 1.75 | 1.25 |
| P2125/93425 (45 ns.) | 7.95 | 7.35 | 7.25 |
| 6508 1K x 1 CMOS | 7.95 | 7.95 | 7.25 |
| 6518 1K x 1 CMOS | 7.95 | 7.95 | 7.25 |
| 74S189 64 bit Ram | 3.95 | 3.25 | 2.50 |
| 8155 I/O w/Ram 21.95 | | | |
| 2147 Low Power 4K Static 14.95 ea. | | | |

### CHARGE COUPLED DEVICES

16K CCD - First time offered Fairchild 460 CCD 16K Memory (now you can experiment with CCD technology at a reasonable price. 17 page Application note supplied with each order. Quantity limited)

**$18.95 each (reg. 43.00)**

### CRYSTALS

**Microprocessor Timebases TV Game**

| Frequency | Price | Frequency | Price |
|---|---|---|---|
| 1.0MHz | $5.85 | 6.0MHz | $ 4.95 |
| 1.8432 | 4.95 | 6.144 | 4.95 |
| 2.0MHz | 5.85 | 6.5536 | 4.95 |
| 2.01MHz | 2.95 | 10.0MHz | 4.95 |
| 2.097152MHz | 5.85 | 13.0MHz | 4.95 |
| 2.4576MHz | 5.85 | 14.31818 | 4.95 |
| 3.579545MHz | 1.50 | 18.0MHz | 4.95 |
| 4.0MHz | 4.95 | 18.432MHz | 5.95 |
| 4.194304MHz | 5.95 | 20.0MHz | 4.95 |
| 4.91520MHz | 5.95 | 22.1184MHz | 5.95 |
| 5.0MHz | 4.95 | 27.0MHz | 5.95 |
| 5.0688 | 4.95 | 36.0MHz | 5.95 |
| 5.7143MHz | 5.95 | 48.0MHz | 5.95 |
| | | 100KC | 12.95 |

### DISPLAYS/OPTO/LED'S

**★ 7 SEGMENT ★ CALC ★ CLOCKS ★**

| | |
|---|---|
| DL 704 (CC), DL 707 (CA) .300" Red | .99 |
| FND 357 (CC) .357" Red | .99 |
| FND 500/503 (CC) .500" Red | .99 |
| FND 507/510 (CA) .500" Red | .99 |
| FND 800/803 (CC) .800" Red | 1.75 |
| FND 807/810 (CA) .800" Red | 1.75 |
| XAN 3062 .500" Green | 1.15 |
| HP5082-7731 (CA) .300" Red | .99 |
| 9 Digit Bubble Mini Calc. Display | .99 |
| 9 Digit Panaplex Display .400" | .99 |
| 9 Digit Fluorescent .300" | .99 |
| MA1003 12V Auto Clock Module | **15.95** |
| Bezel for MA1003 w/Red Filter | 4.95 |
| MA1002A LED 12 hr. Clock Module | 10.95 |

**★ HEX DISPLAYS ★ ENCODED DISPLAYS ★**

| | |
|---|---|
| HP 5082-7340 Red Hexidecimal | 15.95 |
| HP 5082-7300 Red Nymeric | 14.95 |
| TIL 306 Numeric w/Logic | 8.95 |
| TIL 308 Number w/Logic | 8.95 |
| TIL 309 Number w/Logic | 8.95 |
| TIL 311 Hexadecimal | 12.95 |
| MAN 2A .320" Red Alpha-Numeric | 5.95 |
| MAN 10A .270" Red Alpha-Numeric | 8.95 |

### SOCKETS

| | | | |
|---|---|---|---|
| 8 Pin W/W | 32 | 8 Pin S/T | 17 |
| 14 Pin W/W | 37 | 14 Pin S/T | 20 |
| 16 Pin W/W | 38 | 16 Pin S/T | 22 |
| 18 Pin W/W | 60 | 18 Pin S/T | 31 |
| 20 Pin W/W | 90 | 20 Pin S/T | 34 |
| 22 Pin W/W | 93 | 22 Pin S/T | 35 |
| 24 Pin W/W | 85 | 24 Pin S/T | 41 |
| 28 Pin W/W | 1.15 | 28 Pin S/T | 49 |
| 40 Pin W/W | 1.49 | 40 Pin S/T | 63 |

### TEXTOOL ZERO INSERTION FORCE SOCKETS

16 Pin $ 5.50 24 Pin $7.50
40 Pin $10.25

### CONNECTORS

| | |
|---|---|
| DB25P (RS232) | 3.25 |
| DB25S Female | 3.75 |
| Hood | 1.25 |
| Set w/Hood, Sale | $6.50 |
| 22/44 W/W, S/T, KIM | 2.95 |
| 43/86 W/W, S/T, MOT | 6.50 |
| 50/100 S-100 Connector w/w | 4.25 |
| 50/100 S-100 Connector s/t | 3.25 |

### CTS DIPSWITCHES

| | | | |
|---|---|---|---|
| CTS206-4 | $1.75 | CTS206-8 | $1.95 |
| CTS206-5 | $1.75 | CTS206-9 | $1.95 |
| CTS206-6 | $1.75 | CTS206-10 | $1.95 |
| CTS206-7 | $1.75 | | |

### NAKED PC BOARD SALE

| | |
|---|---|
| Z-80 CPU (Ithaca) | $34.95 |
| 8080A CPU | 34.95 |
| 8K Static RAM (Logos) | 21.95 |
| 16K Static RAM (2114) | 29.95 |
| 32K Static RAM (2114) | 49.95 |
| Floppy I/O (Tarbell) | 39.95 |
| Cassette I/O (Tarbell) | 29.95 |
| 8K Eprom (2708) | 21.95 |
| 1702 Eprom Board | 30.00 |
| 2708/2716 Eprom (Ithaca) | 34.95 |
| 2708/2716 Eprom (WMC) | 30.00 |
| Realtime Clock | 34.95 |
| ACP Proto Bd. (3M Conn.) | 27.95 |
| Vector 8800 Proto | 19.95 |
| Vector 8803 11 slot MB | 29.95 |
| ACP Extender w/Conn. | 15.95 |
| Video Interface (SSM) | 27.95 |
| Parallel Interface (SSM) | 27.95 |
| 13 Slot MotherBoard (WMC) | 32.95 |
| 9 Slot MotherBoard (WMC) | 29.95 |
| 8 Slot Mother (expandable) | 34.95 |

### WAVEFORM GENERATORS

| | |
|---|---|
| 8038 Function Gen | 3.95 |
| MC4024 VCO | 2.45 |
| LM566 VCO | 1.75 |
| XR2206 Function Generator | 5.25 |

### FLOPPY DISK I/O

| | |
|---|---|
| 1771-01 8" & Minifloppy | 27.95 |
| uPd372 Nec Floppy | 49.95 |
| 1781 Dual Floppy | 29.95 |
| 1791 Dual Floppy | 39.95 |

### TV INTERFACES

| | |
|---|---|
| Pixie-Verter | 8.50 |
| TV-1 Video Interface | 8.95 |
| Microverter | 35.00 |
| M&R Modulator | 35.00 |

### SPECIAL PURCHASE (while supply lasts)

21L02-4 (450 ns) 100 @ 99¢ ea.
21L02-2 (250 ns) 100 @ $1.15 ea.
TMS4060 NL 4K Dynamic RAMS (pullouts) $1.95 ea.
1488 Line Receiver 100 @ 75¢ ea.
1489 Line Driver 100 @ 75¢ ea.
1489 House Marked 100 @ 50¢ ea.
1496 L Demodulator 25 @ 75¢ ea.

### COMPUTER SPECIALS

| | LIST | SALE |
|---|---|---|
| Apple II Plus w/16K | 1195. | 990. |
| PET 2001-16N | 995. | 895. |
| Exidy Sorcerer w/8K | 895. | 795. |
| Compucolor II w/8K | 1495. | 1395. |
| Cromemco Sys III | 5990. | 4990. |
| Horizon I w/16K | 1599. | 1349. |
| TEI PI208 w/32K dual floppy & CRT (1 avail.) | 4995 | 2995 |
| Pascal Microengine | 2995 | 2395 |

| | | |
|---|---|---|
| IPSI 1620 Diable RO | 3295. | 2695. |
| Anadex DP 8000 | 995. | 895. |
| Centronics Micro P-1 | 595. | 395. |
| Centronics Micro S-1 | 595. | 525. |
| Soroc IQ 120 | 995. | 850. |
| Teletype Model 43 | 1349. | 1150. |
| HiPlot Plotter | 1085. | 899. |
| HiPlot Digitizer | 795. | 735. |
| Intertube II | 895. | 784. |

**★ LED's ★ OPTOISOLATERS ★**

| | |
|---|---|
| LEDS Red, Yellow, Green 185 | 5/1.00 |
| MCT 2 Photo XSTR HFE 250, 30V | .99 |
| 4N25 Photo XSTR HFE 250, 30V | 1.29 |
| 4N33 Photo Darlington | 1.75 |
| FPT 110B Photo XSTR Flat Lense | **SALE** 4/1.00 |

### MONTHLY IC SPECIALS

| | |
|---|---|
| LF13508 JFET Anlog Multi 8 bit | 8.95 |
| ICM7208 Seven Decade Counter | 17.95 |
| ICM7207 Oscillator Controller | 6.95 |
| ICM7045 Precision Sto/Watch Timer | 22.95 |
| ICL7107 3½ Digit A/D (LED) | 14.95 |
| ICL8211 Voltage Reference | 1.95 |
| LM390 Battery OP. Audio Amp | 3/1.00 |
| LM1850 Ground Fault IC | 3/1.00 |
| LM1800 Phase Lock Loop FM Stereo | 3/1.00 |
| LM1820 AM Radio | 3/1.00 |
| DS3625 Dual Mos Sense Amp | 2.50 |

| | | | |
|---|---|---|---|
| 1408L8 | 4/19.95 | 10147 ECL Ram | 9.95 |
| 1488/1489 | 2/1.99 | LF356HBiFet | 3/1.99 |
| 22 Pin S/T Socket | 10/1.00 | MCM14505 | 8.95 |
| 8223 Prom | 2.95 | 74S89 | 3/1.99 |
| MK5014 Calc. | 2/1.99 | 74107N | 6/1.99 |
| 74141N | 3/1.99 | 75452N | 6/1.99 |
| 8T26/8T28 | 2.39 | 741N-14 | 10/1.99 |
| 95H90 | 9.95 | 555CN | 5/1.99 |
| 8281 | .50 | 556CN | 3/1.99 |

### TV CHIPS/SOUND

| | |
|---|---|
| AY38500-1 6 Games B/W | $4.95 |
| AY38515 Color Converter | 2.95 |
| AY38603-1 Roadrace Game | 8.95 |
| AY38605-1 Warfare Game | 9.50 |
| AY38606-1 Wipeout Game | 9.50 |
| AY38607-1 Shooting Gallery | 8.95 |
| AY38910 Gimini Cricket Sound Generator | 12.95 |
| SN76477 TI Sound Generator | 3.95 |
| MM5320/21 TV Synch Gen. | 9.95 |
| MM5369 Prescaler | 3.95 |
| LM1889 RF Modulator | 3.95 |
| MM571000 NSC Color TV Game | 6.95 |
| MM57104 Clock Gen. | 3.75 |
| RF Modulator w/Audio | 8.95 |

All Shipments FCM or UPS. Orders under $100.00 add 5% handling and postage. Orders over $100.00 add 2.5% handling & postage. Mastercharge/ B of A /American Express/ COD accepted w/25% deposit. California Residents add 6% tax. Foreign Orders add 8% handling. All parts prime factory tested guaranteed. Add .35 cents for Data.

Retail pricing may vary from Mail Order Pricing. All pricing subject to change without notice.

P. O. BOX 17329 Irvine, California 92713 Phone (714) 558-8813
TWX: 910-595-1565

Retail Store Open Mon. – Sat.
Located at 1310 "B" E. Edinger,
Santa Ana, CA 92705

CIRCLE 103 ON READER SERVICE CARD

## Manufacturing, con't...

flow requirements needed to support profit goals will influence total production volumes during any build cycle. But, this could put the cart ahead of the horse. How well your manufacturing operation can support any particular build volume is directly related to facility planning. At any rate, the cash flow may be limited by the number of products your facility can handle. The factors involved become more complex as the number of products increase. Computer aided facilities planning provides a means of reducing the complexity and obtaining nearly instant analysis of what-if questions about capacity and facility considerations.

Program Spending - How much money will be spent by the various operating functions is outlined here. The return on investment for the product will tie into the amount of money spent to produce in it manufacturing. The cost of Design Development, Marketing, Distribution and Sale are involved also. The specifics are best left to your accounting techniques (our effort here is with the cost of manufacture).

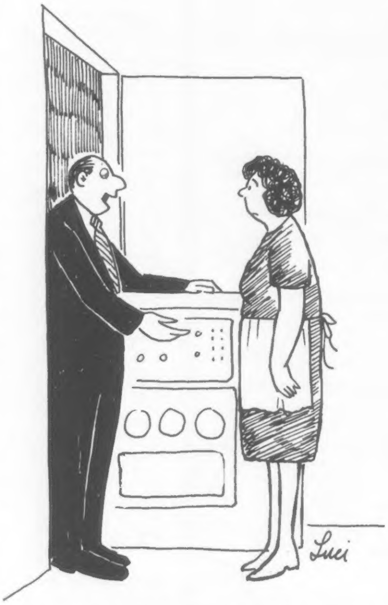
Generally, the manufacturing costs will be catagorized according to whether you make or buy the various components. If you buy and the parts are not standard, then you will have supplier tooling costs. If you can't get parts on time, then you may want to spend premium money to help the schedule. Making the part in-house would depend on available facilities and know-how.

If you know how, then capital tooling, machinery and equipment may be needed. Analysis of making the part when you don't have either the facility or know-how is another consideration. For most small manufacturers, this is often out of the question. However, vertical integration is a way to develop and grow. Don't overlook it, but be aware that it will increase operating costs and overhead. Computerization of the make-buy decision will simplify this task and there are programs available from such sources as SRI Basic Software Library to help you get started. (I have used this and a number of other programs from the library. They have all worked.)

Production Facilities - In most manufacturing operations, space for the following is needed:

Assembly Lines & Work Stations
Material Storage-Incoming & Outgoing
Offices
Utility Areas-Cafeteria, Maintenance
Rest Rooms & Medical

Each item takes a percentage of the available space. Allotment of space depends on the type of product and a general guideline is not practical. If your product is mostly a service, then large office space and very little material storage is needed. If you produce a product made of small electronic components or one made mostly of sheet-metal, then different facility considerations must be made for each. The Industrial Engineering Handbook, the Handbook of Modern Manufacturing Management, and The Handbook of Industrial Engineering and Management are indispensible reference sources for developing any manufacturing environment. Figure 3 includes a graphical representation of a facility distribution and factors for determining requirements. These factors, representative of an electronic assembly environment, can easily be computerized for automated facility planning.



*"Hope you don't mind my bringing the boss home to dinner."*

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Production Build Schedules - Producing the product is the end result of all the planning, development and implementation of operations activities. At this point, a Master Task Plan, illustrated in Figure 4, should be provided. This plan does not take the place of the Manufacturing Plan, but is supplementary to it. The purpose of the Master Task Plan is to show graphically how the supply and support functions relate to the actual build schedule. There are many ways to show these relationships, but a simple bar chart will work in most cases. It can be quickly developed and easily maintained (and understood by anyone). Activities to support the start-up of, and to maintain production build, are highlighted on the Master Task Plan. Any activity that is out-of-step or requires special support can be spotted by use of graphic planning charts. The production build schedule becomes the center of focus for the other activities listed on the chart. Such a chart should be programmed to take advantage of the system data base.

Production build and start-up needs a special mention at this point. The production build bar in Figure 4 shows a number, increasing in size, in each month. These numbers represent the product build-up curve. Any new product or any product built periodically needs to be built-up to peak requirements over a period of time. The period of time varies with the nature of the product. It is the nature of people, the production workers and the people that support production, to need a period of learning. So, a product build-up curve should reflect the learning rate that can be supported by your particular Operations facility. We'll get into this more when we discuss Progress Curves.

### To Be Continued

The next installment of this article will continue with discussions of contributors to the Data Base. Included will be:

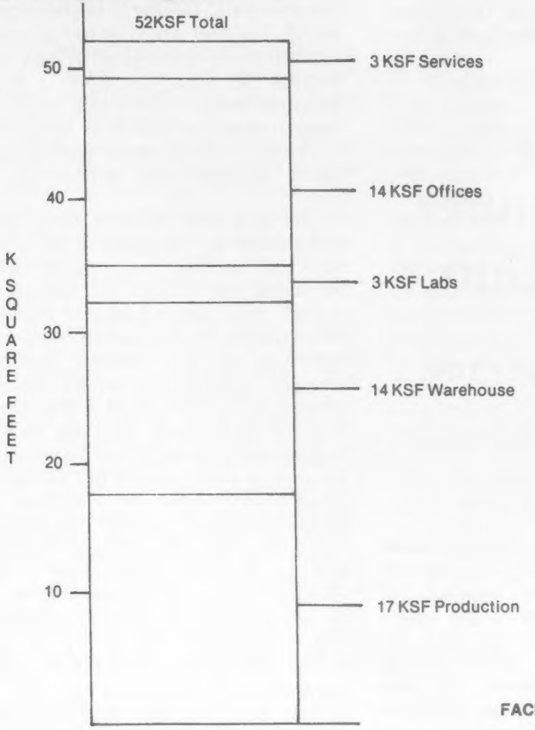
Manufacturing Bill of Materials
Assembly Instructions
Work Station Development
Labor Standards
Product Cost Estimating
Manpower Planning
Packaging and Shipping
Progress and Efficiency

Some more data base users:

Quality Plan
Reports

Also included will be some sample programs for the Apple II system along with the conclusion. ☐

# Manufacturing, con't...



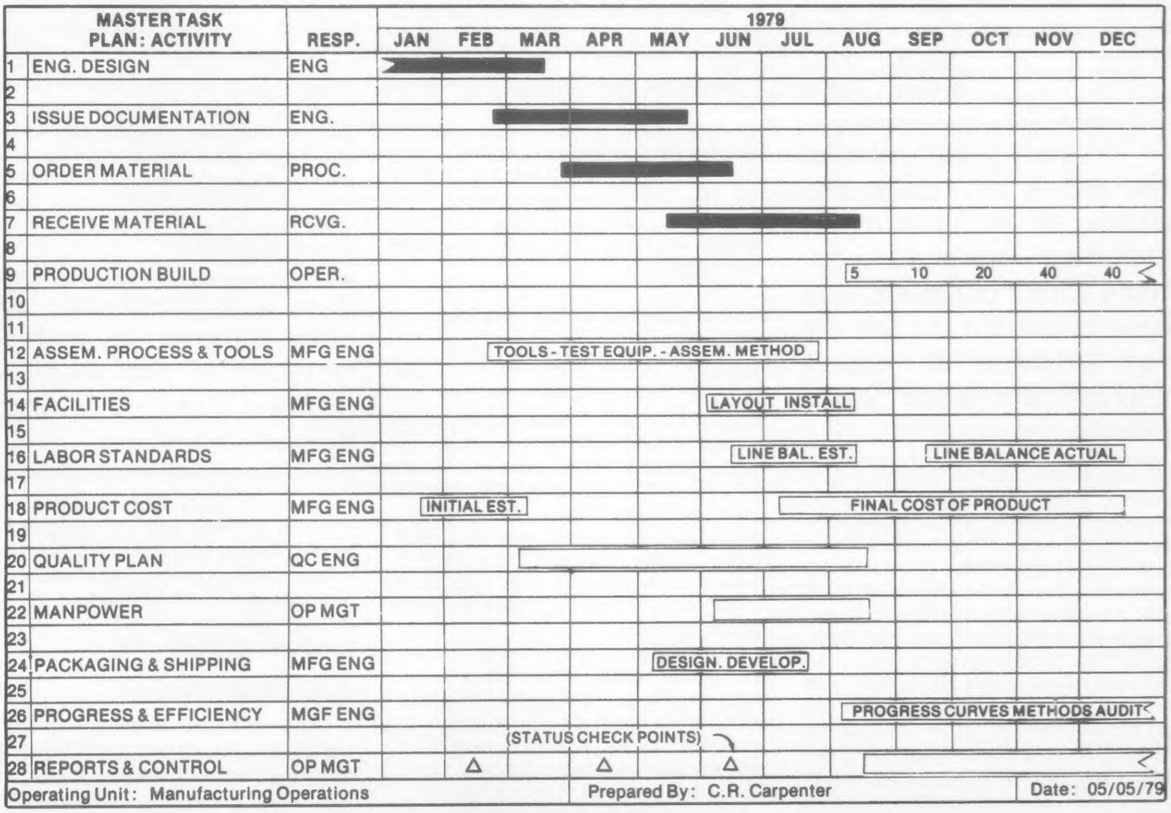
**Space Calculations**

Total Facility = Manufacturing + Warehouse + Services + Labs + Offices.
Manufacturing = Production x 1.25 (Aisles & Mtl.)
Production = Work Stations x 120 sq. ft. x 1.25 Production Support.
Work Stations = Labor Std. x Allowances ÷ Cycle Time.
Warehouse = 0.8 x Manufacturing
Services = 0.2 x Manufacturing
Labs = 0.15 x Manufacturing
Office People = 1.74 x Direct Labor
Office Space = People x 150 sq. ft.
Directs = Labor Std. x Units ÷ Factors
Factors = Efficiency x Attendance x Utilization.

NOTE: This is an example of a space calculation. Figures must be adjusted to the personality and environment of your specific application.

**FACILITIES REQUIREMENTS**

Figure 3. Facilities Requirements.



| | MASTER TASK PLAN: ACTIVITY | RESP. | 1979<br>JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ENG. DESIGN | ENG | ■ | ■ | ■ | | | | | | | | | |
| 2 | | | | | | | | | | | | | | |
| 3 | ISSUE DOCUMENTATION | ENG. | | ■ | ■ | ■ | ■ | | | | | | | |
| 4 | | | | | | | | | | | | | | |
| 5 | ORDER MATERIAL | PROC. | | | ■ | ■ | ■ | ■ | | | | | | |
| 6 | | | | | | | | | | | | | | |
| 7 | RECEIVE MATERIAL | RCVG. | | | | | ■ | ■ | ■ | ■ | | | | |
| 8 | | | | | | | | | | | | | | |
| 9 | PRODUCTION BUILD | OPER. | | | | | | | | 5 | 10 | 20 | 40 | 40 < |
| 10 | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | |
| 12 | ASSEM. PROCESS & TOOLS | MFG ENG | | | TOOLS - TEST EQUIP. - ASSEM. METHOD | | | | | | | | | |
| 13 | | | | | | | | | | | | | | |
| 14 | FACILITIES | MFG ENG | | | | | | LAYOUT INSTALL | | | | | | |
| 15 | | | | | | | | | | | | | | |
| 16 | LABOR STANDARDS | MFG ENG | | | | | | LINE BAL. EST. | | | LINE BALANCE ACTUAL | | | |
| 17 | | | | | | | | | | | | | | |
| 18 | PRODUCT COST | MFG ENG | INITIAL EST. | | | | | | FINAL COST OF PRODUCT | | | | | |
| 19 | | | | | | | | | | | | | | |
| 20 | QUALITY PLAN | QC ENG | | | □ | □ | □ | □ | □ | □ | | | | |
| 21 | | | | | | | | | | | | | | |
| 22 | MANPOWER | OP MGT | | | | | | □ | □ | □ | | | | |
| 23 | | | | | | | | | | | | | | |
| 24 | PACKAGING & SHIPPING | MFG ENG | | | | | DESIGN. DEVELOP. | | | | | | | |
| 25 | | | | | | | | | | | | | | |
| 26 | PROGRESS & EFFICIENCY | MGF ENG | | | | | | | | PROGRESS CURVES METHODS AUDIT< | | | | |
| 27 | | | | | (STATUS CHECK POINTS) | | | | | | | | | |
| 28 | REPORTS & CONTROL | OP MGT | | △ | | △ | | △ | | □ | □ | □ | □ | □ < |

Operating Unit: Manufacturing Operations — Prepared By: C.R. Carpenter — Date: 05/05/79

Figure 4. Master Task Plan.

# The Computer As A Gun

**Gregory Yob**

### To Review The Current Hoopla

It is clear that personal computers will grow at least as rapidly as their larger bretheren; that is, an increase in memory and processing capability of 1000 every ten years. As those of us who own or interact with computers on a daily basis know, it is a tremendously exciting thing to play with an "interactive" tool that can respond instantly to one's immediate actions.

Much of the current enthusiasm (in my opinion) lies in a social reality - at last individuals can own computers. This means a person can do whatever is desired with the machine and not be limited to the goals and priorities of the group that owns the machine. The first reaction was to just play with the machinery itself, and thus the "ALTAIR" age was born. Later, as non-engineers acquired their machines, the main activity was making and playing games. It should be noted that the most popular of these games, such as Pong and Startrek, bear little relationship to daily reality. The personal computer was an escape from the world. At present, the more pragmatic aspects of computers have come to the fore - word processing and personal accounting for example. We are shifting from the idea of "Having my own computer is a revolutionary idea" to "What can this box do for me in my daily world?"

**Programs that predict the prices of stocks and bonds or a system for exploring one's tax options with a complete data base of current tax law are two examples of models that can have rather potent effects.**

The eventual success of personal computers lies very much in answering this question and, if possible, anticipating what the next need will be. It is certain that fixed-purpose products will soon be offered for each clearly identified specific need. I can imagine a set of calculator-type boxes for the common accounting and secretarial functions that are now being explored through personal machines.

### Effective Models and Simulations

One of the "historical" computer games is Hammurabi. You are the king and must allocate grain, buy and sell land, order crops planted and harvested and otherwise attempt to make your kingdom grow and prosper. However, not planting enough grain will bring famine and possibly revolution. Droughts and rats and plague come now and then, and if everything works out well, hordes of immigrants come to settle in your garden of eden.

Well, since this is on a computer, and is not reality, one is free to try different things - try to buy as much land, or to store as much grain, or whatever. If you ignore the necessary balance, the kingdom fails... but on a computer, and not in the real world.

Though Hammurabi is crude, it is effective in teaching how pursuing one goal single-mindedly will cause the economic failure of Hammurabi's world. The real world is full of situations that can be modeled at least well enough to illustrate how a given situation works in principle, and if we keep in mind that factor of 1000 every ten years, some situations will end up being modeled very effectively indeed.

As long as a model's world does not accurately represent a real situation, all is well, no matter what someone learns with an inaccurate model, that learning cannot be used effectively in the real world. However, the incentive to develop accurate models is very strong where mastery of a situation can result in real benefits for those that use the model. Some examples might be mentioned: Programs that predict the prices of stocks and bonds or a system for exploring one's tax options with a complete data base of current tax law are two that can have rather potent effects. If an effective model is developed for an important situation, the widespread availability of personal computers means that many persons will have access to the model, and naturally they will make use of it.

In some cases, such as the stock market, if there are winners, there must be losers, and if many people use an effective model to gain a little, the very nature of the market will have to change. In other words, the models will no longer represent the market, and will therefore not work. The result will be an evolution of new models and, like a chain letter, only those who use a model immediately will benefit very much.

**It is a tremendously exciting thing to play with an "interactive" tool that can respond instantly to one's immediate actions.**

In other cases, like the tax model, it is not so clear that an "automatic" compensation will occur. In fact, it is much more likely that legislative sanctions will be applied or that it could become illegal to use a computer for your taxes!

### Getting Really Personal

The present interactions with computers are mostly symbolic. The machine reads characters and gives you more characters as a response. Of course, graphics and musical and vocal applications are appearing, but

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## As A Gun, con't...

the personal computer at present is a most logical box. As one woman friend mentioned, the PET wasn't cuddly or huggable.

Most of us have heard about ELIZA, the computer program that "listens" to input from a terminal and makes pseudo-thearaputic responses and the secretary who used ELIZA for recreation commented that ELIZA was easier to talk to than many people.

One of the ways we humans differ from machines is our emotional and non-verbal communications. The machine is supposed to be rational, logical and especially importantly, not capable of emotions (or what we perceive to be emotions).

I would like to introduce two heretical ideas - first that human emotional patterns may be much simpler to model than the English language and second, that computers can be given attachments that can communicate non-symbolically, that is, via touch, "body language," or smell.

If these ideas are true, then machines will soon become much more "human," and if you owned one of these "emotional machines" as a personal computer, the personal computer would enter our social world and become a factor in social change.

If we go back to effective models, it is conceivable to think of models that display social behavior. For example, it has been said that when a man and a woman meet for the first time there is a four minute "critical period" which greatly affects whether a friendship will start or not. If a person is a little inept at this gentle art of approach, why not build a computer model that covers most of the common approaches and is sensitive to indications of interest, self-confidence, hesitations and other signs that help or hinder the critical event? Such a model need not cover all possible situations, just the more common ones. I am sure that those who use such a model would be very satisfied at even a 10 per cent improvement in their performance.

Clearly many other social situations might be modeled, and those who want to look at this further should read the story "I Sing The Body Electric," by Ray Bradbury.

### About Guns...

We are in a time where "obviously good" technical ideas, such as nuclear power, are appearing to be not so good. It is no longer clear that a tool, once invented, should be immediately applied. Instead, most of these tools have side effects, some of which are dangerous.

**Machines will soon become much more "human" and if you owned one of these "emotional machines" as a personal computer, the personal computer would enter our social world and become a factor in social change.**

The title of this article mentioned the computer as a gun. A gun presents us with the problem of properly using tools in a very dramatic way. A gun can help the hunter get food, or it can kill people. Effective computer models, especially personable ones, can help individuals become more autonomous, responsible and capable of coping with the world, but we must carefully watch for those that teach how to use the world as an object instead of a set of relations among the web of life. ☐

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# Getting Started With Your North Star Horizon

## Victor K. Heyman

*An examination of some of the books and publications available to the newcomer, along with a response from the author of one of the books mentioned.*

With great expectations and a big outlay of cash you've bought a North Star Horizon along with a terminal like the SOROC or ADM-3 and lugged it home. Now what?

Your dealer has patiently explained where the switches are, how to load disks (which side is up and which is drive 1 versus drive 2) and how the plugs go into the backs of the computer and CRT. He has handed you a big packet of North Star documents, showed you a small sheaf of papers about North Star BASIC and wished you well. You get home, look at the packet, and break into a cold sweat. The documents are in Greek, or they might as well be!

Well, you knew that you were walking into a new world, didn't you? You knew that the computer industry builds boxes and then lets people figure out how to use them, didn't you? You also knew that North Star BASIC, while perhaps as good as Microsoft, is not the BASIC used by the Apple, TRS-80, PET or in most of the programs being published in magazines? No? Well, you are discovering it the first week you have your Horizon home.

**You need to think hard about its value to you.**

So where do you start? You want to get the beast on and running. You want to find out where you can get programs to make your Horizon do something while you are learning. You want to learn the powerful BASIC the North Star speaks and how it differs from other BASICs, particularly Microsoft. OK, here is what to do and what not to do.

### Avoid Panic

The North Star Horizon is a very reliable machine, and your terminal isn't likely to give you trouble. You can bet that most of your problems are going to be made by you, which means you can correct them, with patience.

Buy a box of diskettes the same day you buy the computer, find out how to initialize them (ask your dealer to show you, do it yourself to a couple of disks, then take the computer home). At least you are ready to write a few short lines and can save them to laugh at later. Being able to save a program, bugs and all, and then come back when you have regained your cool is very important. (My first night, I couldn't figure how to save my program on uninitialized disks for an hour after bedtime. That doesn't keep the wife friendly.)

Also, don't leave the store without two or three disks of programs from the North Star Software Exchange. For $10 each you can get some very good programs that will give you some feel for what the computer will do. NSSE 1 has Startrek and Wumpus for the kids. NSSE 6 has a good "Mailer" program for getting up mailing lists, a library control and indexing program, a checkbook balancing program and even a biorhythm charting program. NSSE 8 has a pretty good Othello, Hammurabi and a couple of other programs. If you buy these, you won't have an impossible task on your hands trying to learn everything at once while the CRT stares back at you.

### Don't Buy A Bad Book

The obvious next step would be to buy a book called "The User's Guide to North Star BASIC," by Robert R. Rogers. It is published by Interactive Computers, 7620 Dashwood, Houston, TX 77036. At $19.95, and you need to think hard about its value to you.

There are two versions on the market, both called "First Edition." There is no indication of a second printing or of any revisions. However, the version I bought in November had over 25 typographical errors and at least six programs that would not even run. The second version has its problems, but at least it merits consideration. You can tell the difference by looking at the top of the pages. The second version has short headings with the page numbers. (This partially makes up for the lack of an index and the poor spiral-bound 5" by 7" format.)

**The book has one significant feature that may be worth your money. It devotes much space to data files, both sequential and random.**

The book has one significant feature that may be worth your money. It devotes much space to data files, both sequential and random. There is no other source for such clear statements of how to use them. If you really need to know how to handle such files in North Star BASIC, you will need this book or a good Guru. The book may be cheaper.

In my view, there are four major defects that throw the balance against the purchase. Rogers begins the book with a chapter on starting up the SOL with a North Star disk drive. He claims that these are general procedures. ("All computers, like all cars have the same knobs.") He is wrong. He gives a strong warning against turning on the disk drive with a disk loaded in it. But that is considered by many to be the right way to start a Horizon. The author never does distinguish between what is specific to the SOL and what applies generally to North Star BASIC. Chapter 35, on "Secrets," is entirely SOL except for an incorrect explanation of how to change the DOS to directly boot up into BASIC. And two of the longest

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## Getting Started, con't...

programs in the book are needlessly SOL-specific.

The second major problem is that Rogers writes about an obsolete version of North Star BASIC. The book is written around North Star BASIC Release 3. Release 4 came out in June 1978. It was a major change, making North Star BASIC reasonably competitive with Microsoft, in my opinion, for the first time. No book on North Star BASIC can begin to be worth its cost without dealing with Release 4 explicitly. (Release 5 came out last fall, but it primarily made adjustments for double density disk drives.) Rogers chose to rely mainly on a last minute patch in Chapter 36, on "The New BASIC." It doesn't keep the book from being fundamentally obsolete. For example, Chapter 4, on "How to Display a Program," is about the List command and is totally wrong, as Rogers clarifies in a note. In Release 4, "LIST 500," (with the comma) displays line 500 and all those following it; without the comma, only line 500 is displayed. In later releases, the convention was exactly opposite. The complete stranger to North Star BASIC should be told how the system currently operates, not be given a gold star for noticing that it doesn't work like it used to.

In another example, Chapters 9 and 10 explain the obsolete way to load and save a program on the disks. This used to be tricky before Release 4. NSAVE is all that is needed to save a new program with Release 4 and 5.

Similarly, Chapter 20, "The Random Function," explains a method to get a pseudo-random start for games and simulations. Not only was this made obsolete by RND(-1) in Release 4, it does not work correctly in Release 4.

The instructions on creating safety copies of DOS and BASIC are adequate but, again, Release 4 changed things. BASIC grew from 45 Blocks to 50 (and to 52 in Release 5). The MEMSET command was also added to change the upper boundary of memory ("MEMSET 40959" for 32K). The beginner must learn about MEMSET because otherwise he will not understand why he can't make the computer do anything without a "Memory Full Error." The book gives no help at all here.

The last thing a beginner needs is to have to debug programs in a book meant to instruct him on the fundamentals of BASIC. Nonetheless, even in the second version there is one program that does not work and four others do not work as advertised.

There is a program in the chapter on random numbers which supposedly produces integers from 1 to 10. Unfortunately, the heart of it is INT(10*RND(0)), which produces numbers from 0 to 9.

I have real doubts about teaching a complete beginner about random access data files. But if the instruction is to be given, every program should be a perfect example. An incorrect GOTO in the final program on this subject leads to a "DIMENSION ERROR" that is almost certain to make the beginner stay away from the subject.

There is a general lack of care in the use of language and in the way programs illustrate points. I have the feeling that the author knows better in most cases, but too little effort was made in writing, organizing, selecting techniques and examples for presentation and proof reading. Organization of material is haphazard, even in the second version. Programs presented in later chapters are described in the past tense.

Chapter 14, for the first time, describes initializing a disk so you can write on it. You need to know that before writing your first program, because you can't save the darned thing on a virgin disk. Furthermore, this key instruction is buried in a chapter called "How to Delete A File From a Disk." Try to find that at midnight, particularly when the chapter immediately preceding it has an almost identical title.

**The complete stranger to North Star BASIC should be told how the system currently operates, not be given a gold star for noticing that it doesn't work like it used to.**

There is a safe way and a dangerous way to copy data files in the North Star system. The dangerous technique is to read a specific set of file blocks into memory and then to write them back to disk (using RD and WR in DOS). The safer method is to load and save it by name (LF SAMPLE, SF SAMPLE), as Rogers did in the chapters on copying DOS and BASIC. However, the RD and WR methods are described in the chapter on data files.

Program editing is an essential skill and that chapter is reasonably good. The book has a chapter on hexdecimal conversions, for reasons that escape me, and several on data files, which is good. But there is no explanation of IF...THEN, and none of IF...THEN...ELSE. Trivial? I don't think so.

The chapter on numerical formatting is dangerously deficient. It makes no mention of the horrors of "format errors" that bomb programs when room is not left for a minus sign, or for one more digit than was expected, or for the decimal point itself, or... For the beginner, the rule has to be: don't fiddle with data output formats until you are certain of your data results, and then leave some room for error. No advice of this kind is given anywhere in the book.

**There is a general lack of care in the use of language and in the way programs illustrate points.**

Frankly, I think you can get much more for your $20 elsewhere. And that's too bad. A beginner's introduction to North Star BASIC is badly needed, but I think it needs to be written by someone more knowledgeable about the subject and how to teach it.

### The Essential First Step

The essential first step is to buy "BASIC and the Personal Computer" by Thomas A. Dwyer and Margot Critchfield. This is a marvellously written, warm and coherent introduction to BASIC, mainly Microsoft. North Star BASIC isn't so different that a good book like Dwyer's could lead you astray. Besides, Dwyer knows North Star BASIC, and even gives suggestions for overcoming some of the major incompatibilities.

The book should look familiar to CREATIVE COMPUTING readers. Several excerpts were published by CREATIVE in 1977. For $12.95 you will get a tremendous introduction to BASIC, insights into what programming is really all about and some useful programs that are worth saving on those first disks we talked about earlier. Do youself a very big favor. Buy it.

### The Second Big Step

North Star produces excellent computers, no doubt about it. But their software documentation **used to be** awful. It was not that they didn't tell you what you wanted to know. They did, but not in a language known to most of mankind. Now they have partially redeemed themselves. The essential second step is to buy the

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- I/O AND HOST LANGUAGE INTERFACE ROUTINES ARE ISOLATED FOR EASY ADAPTATION. PATCHES FOR MANY COMMON OPERATING SYSTEMS/BASIC LANGUAGE COMBINATIONS AVAILABLE.

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## Getting Started, con't...

$12 North Star "System Software Manual," called SOFT-DOC for short. It doesn't answer all questions, but it is so superior to the old documentation that clearly North Star has gotten the message that it is building systems for real people to operate.

SOFT-DOC tells you how to start the system. Then it gives an extensive introduction to the whole system. Finally it gives a detailed description of all commands, functions and features. In about 200 pages it tells you everything you need to know, and doesn't even assume that you already know BASIC. (It has a section on "Becoming Familiar With BASIC.") It does not have many sample programs, however, so much of what is said needs reading several times, like once a month for a year.

> **Frankly, I think you can get much more for your $20 elsewhere.**

How could SOFT-DOC be a second step? Well, the first problem you had to overcome was to learn BASIC, right? OK, Dwyer and Critchfield will teach you that and you will enjoy learning. Your second problem was to learn the peculiarities of North Star BASIC (and its Disk Operating System). SOFT-DOC takes care of that, but not in a way that will encourage you to make your fingers tickle the keyboard. If you don't program, you won't learn how to program, it is that simple. The first step is to get into the swing of it, and Dwyer and Critchfield help you swing.

### A Major Third Step

The essential third step may surprise you. You should buy Creative Computing's "Basic Computer Games, Microcomputer Edition." No kidding. If you have the old 101 BASIC Games, throw it away—it will spoil your eyesight and it may keep you from getting the new edition. Now, I don't work for Creative. I don't even write exclusively for Creative. Moreover, I haven't much time for game playing. Why a book on games?

First, the new Micro edition of Games has some very good pieces of Microsoft programming. Translating them into North Star BASIC will give you experience and confidence that you can't get elsewhere. Second, game programs tend to be fairly complex. They require imagination and anticipation of alternative actions by the user (both legal and illegal). You can't help but begin to get a feel for this kind of "human engineering" as you rewrite some of these programs.

Why this book? Simply because it is excellent. Other books on software tend to be more expensive and use "simplified BASIC." That is great for building up your software library, but lousy for learning programming. I want to be more than a typist when I sit at my computer.

### The Final Leap

Whatever computer you own, you will never get the most out of it by yourself. Spend a little money and subscribe to newsletters or magazines published by users of your computer. There isn't one that is viable right now for the Horizon, but I keep hoping that POLARIS, the newsletter of the Palo Alto North Star Users Group, will meet that challenge.

Joining the local computer club is also an essential part of growing as a user and programmer. Give it a chance. If you have a choice, join a club with enthusiasts who use the same kind of computer you have, or at least one that speaks your language. Also, try to find one that shares your interests. If you want to learn programming, make sure that the club is not full of hardware nuts. However, if you don't have a choice, join the local club anyway, get a list of members and start matching names to computers. Those with Horizons or North Star disk systems probably went through the same set of problems you now face. In six months or so, you will be helping somebody new.

> **The essential third step may surprise you. You should buy Creative Computing's "Basic Computer Games, Microcomputer Edition."**

### Summary

From my experience and from watching others, I suspect the new Horizon owner (or almost any computer owner) has a period of three to six weeks of very painful learning after getting his or her computer home. There is just too much to learn, and all at once. For those who can't stand frustration, I suggest you sit out the next year or so of computermania.

Buy the right books and work with others. That is the best way I know to get started—with your North Star Horizon or any other computer. ☐

## Response from Robert R. Rogers, author of "The User's Guide to North Star BASIC."

I received a letter from John Craig of **Creative Computing** asking me to respond to an upcoming review of my book, "The User's Guide to North Star BASIC." I thought this was strange since the book has been reviewed in other publications and I had never received such a request. What made this review different was that it was labeled a "Negative Review." I can only surmise the reason I never got a "request for response" before was that I never got a bad review before. I guess I've been lucky up until now. Mr. Craig felt that "we would all benefit from the response." Perhaps so. Regardless of the motivation, I welcome the opportunity.

Mr. Heyman, I think you're mad at me because the book didn't exactly fit your computer and you didn't, or couldn't, relate to both of them at the same time (i.e., your frustrations are showing). I can assure you it takes more than "patience" to get a system up and running. It also requires reading more than one book. To my knowledge, and I've read scores of computer books, not a single one is adequate.

Somewhere along the line, from the time you purchased my book until now, you've learned the basics. Whether you want to admit it or not, I'll take part of the credit for teaching them to you, through my book. You get most of the credit for refining this foundation of knowledge from your investment of many hours of trial-and-error learning. Now you have reached the position that you can examine and evaluate. Great. My book did exactly what it was intended to do. You're not only questioning the value of the text but you know enough to ask the right questions.

Now I would like to respond to some of the specific points made in the review. The omission of any particular point does not suggest agreement on my part, but rather a conservation of limited space, or the lack of merit of a particular point to justify a response.

With regard to sequential and random access of data files, you stated, "There is no other source for such clear statements of how to use them," than my book. You're right! The same can be said for the on statement, random function, chain command, numerical format, disk operation, and so on, and so on...

## Getting Started, con't...

The fact that you question whether or not it's worth spending twenty dollars (you got ripped off - the book sells for $14.95) to learn and fully understand the use of data files, leads me to believe that you primarily use your computer for playing preprogrammed computer games. For those who bought their system to assist in business or scientific endeavors, understanding data file manipulation is the heart of the computer's worth. After a hardware investment of three to fifteen thousand dollars, I don't think $14.95 is out of line. I would gladly have paid it. I took the other route - a hundred plus wee morning hours, trying to figure it all out by myself. I would have much preferred spending that time using the data than trying to figure out how to get it in and out of the computer.

With regard to writing about an obsolete version of North Star BASIC - I wrote the users guide to North Star BASIC during April and May of 1978. If I had waited to write it in July, I would have written it for release 4. If I had waited to write it the following February I would have written it for release 5. If I had started in April of 1979, I would have written it for release 6. If I wait til next year I can write it for Version XYZ, for double density and quadra-phonic sound.

The newer versions only add features to North Star's BASIC. The version I used is not unlike the current version, in that the current version contains all that I have written about, and then some. The beginner will encounter few, if any, problems that I have not mentioned in the book. Any person competent and comfortable with the information in my book could easily understand and use all the features of the later versions.

With regard to the "Obsolete way to load and save," if you don't know how to fully take advantage of the features provided by North Star for operations in the DOS mode - then you're not taking full advantage of your system. North Star has provided the user the flexibility of controlling his system regardless of the operation mode.

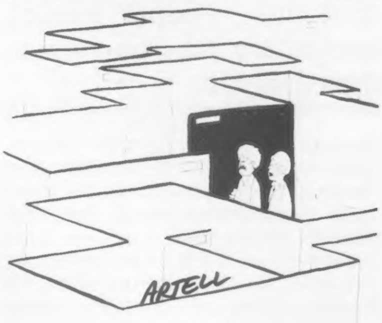
I question the statement that there is one program in the book that "doesn't even work." Since the bad program wasn't specified, and they all run for me, I can't comment. However, conceding the point, there are about a hundred other useful programs in the book that work like a charm.

Mr. Heyman goes on to say that he has serious doubts about "teaching a complete beginner about random access (of) data files." Properly presented, as I have done in my book, understanding random access should present the "complete beginner" with no more hassle than understanding any other phase of BASIC. Some lessons are easier than others but none are beyond the comprehension of most.

I think that the organization of the book, or "lack of it" as stated in the review, clearly reflects a difference of opinion. How does one best present the hundreds of facts that a newcomer seemingly must acquire simultaneously in order to become proficient in BASIC. I personally don't feel that a person should necessarily save his "first" program. Therefore, that kind of information isn't needed in the early part of the book. I would prefer that time be invested in learning to expand program writing techniques.

I would like to cover one last specific point. Mr. Heyman states, "the book has a chapter on hexdecimal conversions, for reasons that escape me." Mr. Heyman, I'm not surprised. As time goes on, and you continue to struggle, the need for such knowledge hopefully will become evident.

A common thread that I've noticed throughout this book review is the ever-pressing need to protect the beginner from all adversity. Mr. Heyman states that he has doubts about "teaching a complete beginner about random access." He's cautioned the beginner not to "fiddle with data output." He's denied him the "need to debug." Mr. Heyman, I can only surmise that your insecurity with your system has spilled over into a review of my book. After reading the review of my book I better understand your preference for "a marvellously written, warm" introduction to BASIC. I say, "damn the torpedos - plow ahead." □



*"Pardon me, are we going to the personnel office, or is this part of the psychological testing?"* ©Creative Computing

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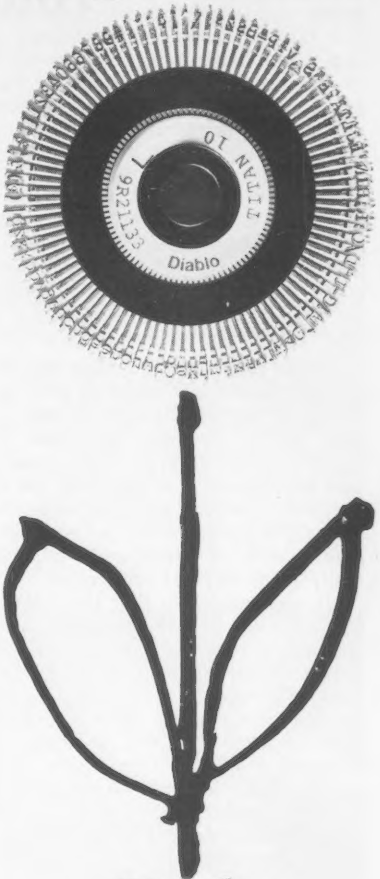

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**Chess Games & Micro Programs Battle It Out**

# 1st Creative Computing Microcomputer Chess Tournament

*This is the first in a series of computer chess tournaments to be held by Creative Computing. Programs and manufacturers are encouraged to submit their products to Contributing Editor Stephen Kimmel for inclusion in the next round of the "battle."*
*— John Craig*

### Stephen Kimmel

*Whether you play chess or not, you'll enjoy this account of microcomputer games and programs being pitted against one another.*

When International Chess Grandmaster David Levy wagered that no computer program would be able to beat him in the next ten years, it became obvious that computer chess was big money. It always has been. Millions have been spent on research projects studying chess as an exercise in artificial intelligence, but the really big money was yet to come.

It was inevitable that the microcomputer would enter the scene. The big money came to computer chess as the computer became inexpensive enough for everyone to afford one. Hordes of machines and programs began to bid for the millions of customer dollars. The claims are myriad. Boris is King! Challenger is the best. Karpov is afraid of our Chess Computer. Sargon: The 1978 champion. Microchess 1.5 is the best computer chess program. There is an old saying: The amazing thing about dancing bears isn't how well they dance but that they dance at all. Insert obvious paraphrase.

How much of the noise is advertising hype? How much of it is due to the skill of the programmers? Are any of them any good or is microcomputer chess still in its dancing bear phase? Which of them plays the best game of chess? How many writers are telling us they don't dance as well as bears?

Armed with several pounds of salt, I pitted five of the best known (read most highly advertised) against each other in a microcomputer chess tournament to answer these questions. However, since nobody buys computers to have them play each other, I insured the relevance to human players by including two rated humans.

HUMAN 1400 is an average tournament chess player with an official rating of 1400. The scale runs from 400 to Karpov's 3000+. He started playing chess at age 7 and has played in numerous tournaments. He prefers a wide open game.

HUMAN 1000 is an average chess player. He never studied chess, except for the opening, and hadn't played for ten years before his recent series of games. HUMAN 1000 has a fair grasp of basic strategy, good ability in the opening part of the game and plays conservatively.

**Time**

There is a subtle difference between playing another human and playing a computer. People expect computers to be faster than they are. People are reassured when the computer takes more time to find the move they selected.

**There is a subtle difference between playing another human and playing a computer. People expect computers to be faster than they are.**

There is also a boredom threshold. Of six humans I tried, all showed signs of boredom when required to wait over three minutes. Try it yourself, put something on a computer screen and see how long you can look at it without fidgeting. The human player simply won't wait very long for the computer to make its only legal move. The most desirable time appears to be between one and two minutes, more time becomes a burden over a fifty move game. If the computer is playing well, shorter times become intimidating.

There's a lot of confusion in the computer chess world with the myriad of conflicting claims.

I set each machine so that it took as much time as possible under three minutes. All of the programs except Microchess 1.5 could be set higher. Normally the next setting was much higher. Chess Challenger took six minutes at it's next setting. Sargon averaged 10 minutes. JS&A took four hours. These levels are too long to be practical.

**The Tournament**

The first computer contestant was Microchess 1.5, which I purchased at a Radio Shack. Written in 1976 by Peter Jennings and marketed by Personal Software, Microchess 1.5 is the old man of the group. I ran it on a 4K TRS-80.

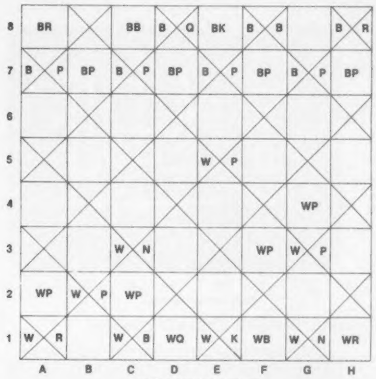
Microchess 1.5 evokes the same sadness as Eniac. In it's day, it was a triumph of innovation and programming ability. Now, like Eniac, it is mainly an historical curiosity. Microchess 1.5 didn't win a single game in the tournament. It's style of play was described by one spectator as "Attack

Stephen Kimmel, 4756 S. Irvington Pl., Tulsa, OK 74135.

## Chess Tournament, con't...

at all costs." As black, it seemed particularly prone to develop one piece, move it until it lost it, and develop another piece as illustrated in Figure 1. This is a hideously bad style of play. I inquired of Personal Software if there was a problem with my tape. They offered me my money back. I plan on taking it and I suggest you do the same.

If chess on microcomputers is like a dancing bear, then Microchess 1.5 is a dancing bear in a telephone booth. It only requires 4K and that's the only reason I can think of for buying one. HUMAN 1000 beat Microchess handily twice and said, "I've played worse chess players but I don't remember when." HUMAN 1400's included the shortest game of the tournament, a ten move classic. He spent a substantial amount of his time laughing.



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| 2 | WP | W P | WP |  |  |  |  |  |
| 1 | W R |  | W B | WQ | W K | WB | W N | WR |
|   | A | B | C | D | E | F | G | H |

Position After 8 PxN H2-G3

| BORIS...3 Minutes |  |  | Microchess 1.5 (IQ = 3) |  |
|---|---|---|---|---|
| 1 P-Q4 |  | d2-d4 | N-KB3 | g8-f6 |
| 2 N-QB3 |  | b1-c3 | N-N5 | f6-g4 |
| 3 P-KB3 |  | f2-f3 | N-KB3 | g4-f6 |
| 4 P-K4 |  | e2-e4 | N-QB3 | b8-c6 |
| 5 P-K5 |  | e4-e5 | N-KR4 | f6-h5 |
| 6 P-KN4 |  | g2-g4 | NxP(K5) | c6-e5 |
| 7 PxN(K5) |  | d4-e5 | N-N6 | h5-g3 |
| 8 PxN |  | h2-g3 | P-Q4 | d7-d5 |
| 9 QxP |  | d1-d5 | QxQ | d8-d5 |
| 10 NxQ |  | c3-d5 | P-QB3 | c7-c6 |
| 11 N-QB7 | ck | d5-c7 | K-Q1 | e8-d8 |
| 12 NxR |  | c7-a8 | B-K3 | c8-e6 |
| 13 B-KB4 |  | c1-f4 | P-KN4 | g7-g5 |
| 14 R-Q1 | ck | a1-d1 | K-K1 | d8-e8 |
| 15 N-B7 | ckmt | a8-c7 |  |  |

Figure 1. Boris vs. Microchess 1.5.

**Boris also displays the move it considers best so far while it's thinking. This lets you analyze your responses while waiting. It was the only computer that did anything interesting while thinking.**

BORIS was the second unit to arrive and it promptly beat Microchess twice. Figure 1 shows the position after eight moves. Having won two knights for a pawn, Boris has already won the game. It took only seven more moves. Human 1000 beat BORIS twice and HUMAN 1400 routinely increased Boris's computing time. While neither game was difficult, they weren't laughers either.

Boris plays fair chess and is entertaining.

Boris is marketed by Chafitz of Rockville, Maryland through quality stores. They have a toll free number, (800) 638-8280, so you can find out where Boris is sold. It comes in a variety of models ranging from the new Boris Diplomat at $119.95 to a coffee table model that sells for considerably more.

Boris has most of the desirable features. Crisp calculator style keys, an easy-to-read display, random moves between equal alternatives, ability to play both black and white, easy special positioning and move verification and easily understood instructions. Boris also uses a timer system which has advantages and disadvantages. The disadvantage is that it always takes that amount of time even if it only has one move. The advantage is that you always know exactly when it will respond.

Boris also displays the move it considers best so far while it's thinking. This lets you analyze your responses while waiting. It was the only computer that did anything interesting while thinking. We liked this feature very much.

And, of course, the messages. When the computer is ahead, or the game is about even, one liners appear randomly. The cute messages stop when the machine is behind. It isn't Henny Youngman, but it may make Boris the best "entertainment" value. Boris plays a reasonable game, though in the early game it lacks insight. In the end game, when there are fewer alternatives to evaluate, Boris becomes stronger.

Our Sargon tape arrived next. Sargon was written by Kathe and Don Spraklen and is published by Hayden Publishing. I bought my copy from Microtronix. Sargon was run on a 16K TRS-80. It is also available for other machines and in book form. Unfortunately, our Sargon tape wouldn't load. Hayden is aware they have a problem. They are working on it and are very courteous about exchanging tapes. If you are having problems don't hesitate to send yours back.

The JS&A Chess Computer was the next unit to arrive. The unit is manufactured in Hong Kong making it the only foreign entry. At $100, it is only entry with no chess set or display. This unit has real problems. It has very sloppy keys that may require pushing several times or respond more than once to a single push. The display doesn't match the keys which created problems during the tournament.

In its own peculiar way, the JS&A unit is very reassuring. Even Russian chess champions understand the capitalistic concept of hype. Their ads quote Karpov as saying he'd played several games with it at level 6 and found it a challenge. So the first thing I did was to begin a game at level six. It took the JS&A unit between 32 and 42 hours to compute a response to E2-E4 (pawn to king four). Assuming that a game needs 30 moves to qualify as challenging, Karpov must have spent two months per game in the same location. Hype.

The best "dedicated" chess machine - Chess Challenger 7.

The JS&A unit's strategy seems to be "Defend at all costs and attack if you see a free piece or a quick kill." Against weaker players, it spends a lot of its moves waiting for an opening. Against stronger players, it sputters, and gasps and plays moves that HUMAN 1400 described as "simply illiterate." Karpov described it when he said, "You Americans have a saying: Garbage in, garbage out." The unit won't really play white. You can make it move first by entering the illegal move E2-E2 but that produces a mirror image game.

The JS&A Chess Computer was in trouble against Microchess until

## Chess Tournament, con't...

Microchess made a horrifying blunder and lost the game. Their second game ended in a draw, the only game of the tournament Microchess 1.5 didn't lose. Boris, Human 1400 and Human 1000 all beat it convincingly. Human 1400 was laughing again.

The JS&A Chess Computer doesn't check your moves for legality. Combined with the sloppy keys, this leads to numerous mistakes. We found the opening move A5-D8 (empty square takes queen) especially devastating. At this point I thought that Boris might be the ultimate winner in the computer division. So far, none of the units had seriously challenged a human player.

Then Chess Challenger 7 appeared. It is the latest model manufactured and marketed by Fidelity Electronics of Chicago. This model sells for around $100 (just like the JS&A unit). Chess Challenger 10 sells for $275. You can order one by calling (800) 243-5676.

Chess Challenger has fairly crisp keys and an audio feedback system that's nice. It has all the features Boris has except that its special positioning was difficult to master and the instructions were unclear. Chess Challenger's best feature is it's book of openings in memory. This insures that Challenger won't get into trouble early. It also makes Challenger the best chess tutor.

Chess Challenger does have some weak points. It has fine carved wooden chess pieces and plastic sandwich bags to carry them in, but I don't understand why they put magentic weights in pieces to be used with an all plastic board. You actually need a carrying case and a board. The display can be difficult to read in certain lighting. Overall, it is the cheapest looking unit of the group, but it plays a terrific game of chess. At level seven it ruthlessly punishes not only mistakes but weak plays. Challenger made the fewest blunders of any of the computers and its style of play is easily the most human of the programs we examined.

**So far, none of the units had seriously challenged a human player. Then Chess Challenger 7 appeared.**

Challenger creamed JS&A and Microchess. It's game with Human 1400 was a little different. Human 1400 realized that he was in trouble about 15 moves into the game. He was never able to recover and resigned after 42 moves. In this tournament, it was the first time any of the computers had beaten a human. Human 1400's play improved considerably now that he had an opponent he had to be serious about. He won all the rest of his games.

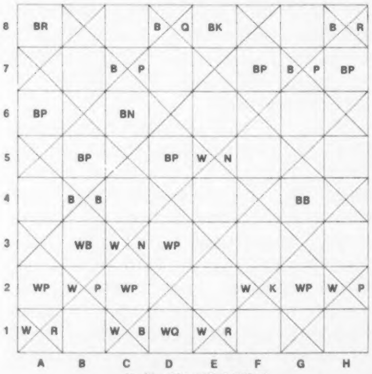
Moral: Microcomputer chess programs aren't as good as an average tournament player...yet...but if you get careless some of them will beat you.

INSTRUCTIONS FOR THE
CHESS CHAMPION

The electronic loser - JS&A Computer Chess.

The matches with Human 1000 became more important. If Challenger could beat Human 1000 twice then it wouldn't make much difference how the other games turned out. Human 1000 was aware of Human 1400's loss and realized that his normal style of play was doomed to defeat. On move 11 Human 1000 offered a queen sacrifice. See Figure 2. Interest in the game suddenly ran high. The foregone assumption that Challenger would have little trouble with Human 1000 crashed. There was a trap. If Challenger accepted the sacrifice, it would eventually lose a piece and perhaps the game. If it declined, then Human 1000's advantage would be much less. The other computers had accepted every sacrifice offered. Speculation was that Challenger would accept the sacrifice and the momentary material advantage.

Chess Challenger 7 declined the sacrifice. It demonstrated much more insight than any of the previous programs. Although Chess Challenger lost both games to Human 1000, there was very little doubt that it would be the eventual computer winner.



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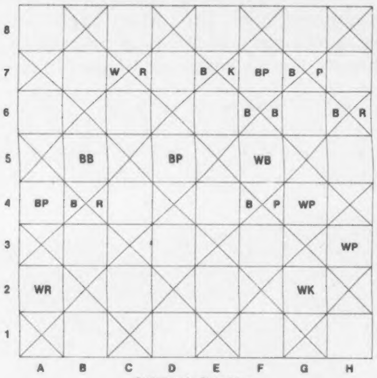
| 8 | BR | | | B Q | BK | | | B R |
| 7 | | | B P | | | BP | B P | BP |
| 6 | BP | | BN | | | | | |
| 5 | | BP | | BP | W N | | | |
| 4 | | B B | | | | | BB | |
| 3 | | WB | W N | WP | | | | |
| 2 | WP | W P | WP | | | W K | WP | W P |
| 1 | W R | | W B | WQ | W R | | | |
| | A | B | C | D | E | F | G | H |

Position After 11 NxP?! F3-E5
Black's Move 11.....Q-R5 CK D8-H4

Figure 2. Human 1000 vs. Chess Challenger.

It came as a surprise when Boris drew Challenger in the first game. The second game is shown in Figure 3. Boris has Challenger in perpetual check. Challenger couldn't find the way out. The game ended in stalemate by repetition. Challenger had drawn both of its games with Boris.



| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 8 | | | | | | | | |
| 7 | | | W R | | B K | BP | B P | |
| 6 | | | | | | B B | | B R |
| 5 | | BB | | BP | | WB | | |
| 4 | BP | B R | | | | B P | WP | |
| 3 | | | | | | | | WP |
| 2 | WR | | | | | | WK | |
| 1 | | | | | | | | |
| | A | B | C | D | E | F | G | H |

Stalemate by Repetition.

Figure 3. Boris vs. Chess Challenger.

The good Sargon tape arrived and the program dispatched JS&A and Microchess with relative ease. Sargon plays an interesting, unhuman game of chess. Still it wins games and was the untied, unbeaten winner of the West Coast tournament. It is a bit too aggressive as black, attacking when it should be consolidating. It's losses stem from this fact. It has a special exchange evaluator that sometimes gives it great depth of insight.

**The outcome of the entire tournament would depend on one last game. I could almost hear Challenger cursing for not being able to break to stalemate with Boris.**

Sargon displays as many as the last ten moves, which is a very nice feature. It took a while to get used to making moves without hitting enter. The graphics are acceptable although it is possible to get confused about which color a piece is. I think they need a feature to number the board. Sargon beat Boris as white but lost as black in two long games. As black, Sargon lost to Challenger.

I was ready to write up Chess Challenger 7 as the computer winner at this point. But one skeptic pointed out that if Sargon could win as white,

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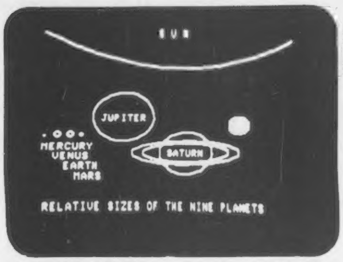
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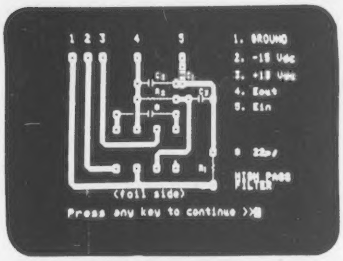
1 2 3 4 5
1. GROUND
2. -15 Vdc
3. +15 Vdc
4. Eout
5. Ein
22pf
HIGH PASS FILTER
(foil side)
Press any key to continue >X

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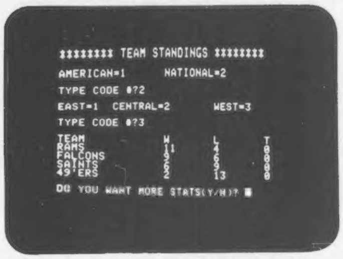

```
######## TEAM STANDINGS ########
AMERICAN=1      NATIONAL=2
TYPE CODE #?2
EAST=1  CENTRAL=2      WEST=3
TYPE CODE #?3
TEAM              W      L      T
RAMS              11     4      0
FALCONS           9      6      0
SAINTS            6      9      0
49'ERS            2      13     0
DO YOU WANT MORE STATS(Y/N)? 
```

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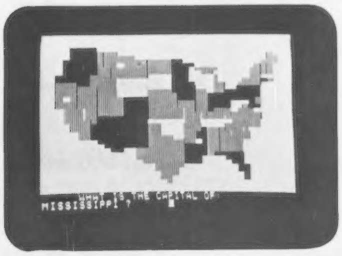
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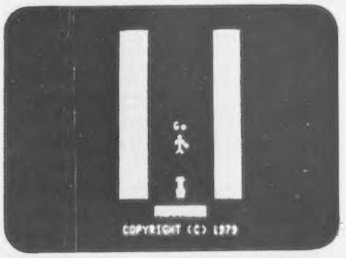
Go
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FORMAT's system of imbedded commands (within the text) give it an ease of operation similar to text formatters found on some mini-computers.

FORMAT features right margin justification, centering, page numbering, anda auto-paragraph indent.

The following commands are available with FORMAT:

| | | |
|---|---|---|
| .ad | | Begin adjusting right margins |
| .bp | n | Begin page numbered n |
| .br | | Cause a line break |
| .ce | n | Center next n lines without fill |
| .fi | | Start filling output lines |
| .fo | t | Foot title becomes t |
| .he | t | Head title becomes t |
| .in | n | Indent n spaces from left margin |
| .li | n | Literal, next n lines are text |
| .ll | n | Line length including indent is n |
| .ls | n | Set line spacing to n |
| .ml | n | Top spacing including head title |
| .m2 | n | Spacing after heading title |
| .m3 | n | Spacing before foot title |
| .m4 | n | Bottom spacing including foot title |
| .na | | Stop adjusting right margins |
| .nf | | Stop filling output lines |
| .pl | n | Page length is n lines |
| .pp | n | Begin paragraph= .sp, .fi, .ti n |
| .sp | n | Space down n lines, except at top |
| .ti | n | Temporary indent of n |
| .ul | n | Underline next n input lines |

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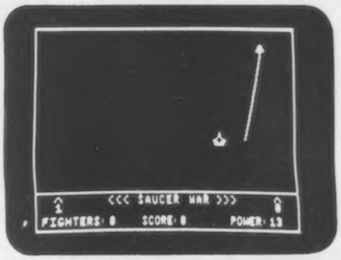
<<< SAUCER WAR >>>
FIGHTERS: 0
SCORE: 0
POWER: 13

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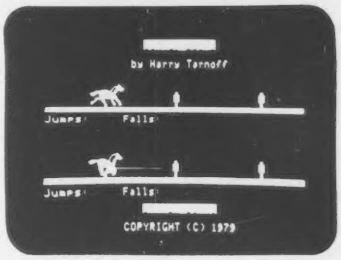
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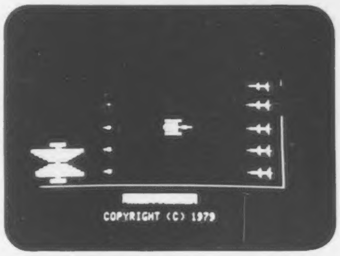
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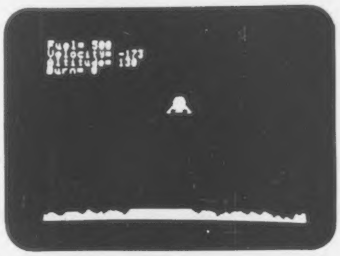
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Velocity= -173
Altitude= 130
Burn= 0

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## Chess Tournament, con't...

as it had against Boris, there would be a three way tie in the computer matches. Boris and Challenger would have records of 5-1-2 while Sargon would be 6-2-0. Sargon won it's second game against Challenger. It lost both games to Human 1400 and as black against Human 1000.

The outcome of the entire tournament would depend on one last game. I could almost hear Challenger cursing for not being able to break to stalemate with Boris. If Human 1000 lost, then Sargon and Challenger would be essentially tied. Any other conclusion and the clear winner would be Chess Challenger 7. After consultation it was decided that Sargon would be declared the winner if it won. Both would have beaten humans playing about as well. And Sargon was taking about half as much time.

**Chafitz has recently hired Atkins and Slate (the programmers of the World Computer Chess Champion Chess 4.6) to work on the Boris program.**

Would Human 1000 do it again to Sargon as he had against Chess Challenger? I imagined this to be a moment of high tension in the microcomputer chess world.

### And The Winner Is...

HUMAN 1400 won eight straight games before suffering his only defeat to Chess Challenger, then he went on to win three more. His record was 11 wins, one loss and was good for an easy first place.

HUMAN 1000 won second place before he played Sargon. He beat Sargon as white, Chess Challenger and Boris only by playing his very best game. These three systems are all rated near the 1100 level. This is slightly weaker than an average tournament chess player. JS&A and Microchess are still in the dancing bear phase.

Human 1000 offered a bizarre swap in the crucial game with Sargon. He traded a knight for three pawns. Materially the trade was about even and it had devastated Sargon's pawn structure. More important though, it prematurely freed Sargon's queen rook. This was a fatal flaw. Six moves later Sargon offered the rook as a sacrifice. The stunned spectators watched the only computer originated sacrifice in the tournament force checkmate. Sargon had beaten Human 1000.

Human 1000 playing Boris while being an interface. (All photos by B. Chilcoat.)

Sargon, therefore, was the computer winner. It is easily the best program available for the home computer. A very close second, essentially a tie, is Chess Challenger 7, the best of the dedicated chess computers. The results are shown in Figure 4.

| WINNER | LOSER | HUMAN 1400 | HUMAN 1000 | SARGON | CHALLENGER | BORIS | JS&A CHESS | MICROCHESS | RECORD (Win-lose-tie) | RATING |
|---|---|---|---|---|---|---|---|---|---|---|
| HUMAN 1400 | W<br>B | | *<br>* | *<br>* | <br>* | *<br>* | *<br>* | *<br>* | 11-1-0 | 1400 |
| HUMAN 1000 | W<br>B | | | * | *<br>* | *<br>* | *<br>* | *<br>* | 9-3-0 | 1325 |
| SARGON<br>2 PLY LOOK AHEAD | W<br>B | | * | | * | * | *<br>* | *<br>* | 7-5-0 | 1100 |
| CHESS CHALLENGER 7<br>LEVEL 7...Avg 3 minutes | W | * | | * | | -<br>- | *<br>* | *<br>* | 6-4-2 | 1100 |
| BORIS<br>3 minutes allowed | W<br>B | | | * | -<br>- | | *<br>* | *<br>* | 5-5-2 | 1050 |
| JS&A COMPUTER CHESS<br>LEVEL 4...Avg 3 minutes | W | | | | | | | -<br>* | 1-10-1 | 750 |
| MICROCHESS 1.5<br>IQ LEVEL 3 | W<br>B | | | | | | - | | 0-11-1 | 650 |

Figure 4. The winners...and the losers.

* = Win
- = Draw

### The Future

The JS&A people tell us that they are discontinuing their Chess Computer. One industry source says that there are legal problems. The JS&A Chess Computer is such an inferior product that it richly deserves to be discontinued. JS&A, though, can be counted on to bring out a new product which should be much better.

Chafitz has recently hired Atkins and Slate (the programmers of the World Computer Chess Champion Chess 4.6 to work on the Boris program. I expect them to add an opening book and introduce a pruning mechanism. Chafitz has just announced a breakthrough that, they say, will revolutionize computer chess though they don't say what it is. My guess, and it's only a guess, is that they've combined a faster clock with Texas Instrument's bubble memory chip. Something like that could really make Boris a unit to be considered, it would be a quantum leap.

Use of Sargon will increase, eventually pushing Microchess 1.5 out of the market. Sargon II, which will probably have an opening book, will come out sometime in the not too distant future.

The future of Microchess is more difficult to predict. Microchess 1.5 is more heavily advertised than Sargon, so it will hold on for a while. Microchess 2.0, the version available for Pet and Apple, is reported to be better than Microchess 1.5. Unless they come out with a version for the TRS-80, I don't see how they hold on to the TRS-80 market.

One of the interesting things about Challenger is how much of the package is computer...less than half. I expect the next model to be the size of a hand-held calculator. This should run in the $50-$75 range. It may even be available for Christmas. I'll probably buy one.

Of course, others will enter the field. Mighty rumors are coming from the manufacturers about the powers of the Atari chess program. I hope to report on that later. As of June 1979, it was unavailable in mid-America.

Cardinal had a unit mentioned in the May issue, though no word is available on how good it is. I fully expect Texas Instruments to get into the act soon.

Sargon and Chess Challenger are the best available now. They have put to rest the dancing bears. Now the amazing thing about chess programs will be how well they play. ☐

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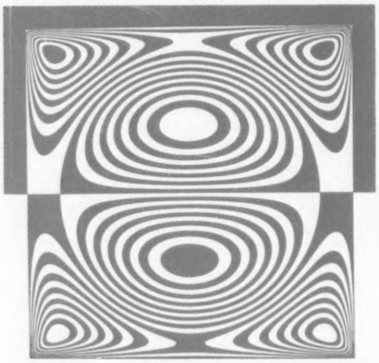
# Art and Technology

### David H. Ahl

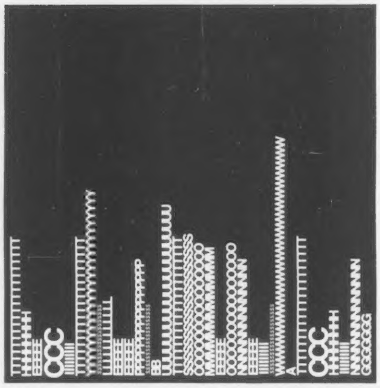
## Introduction

Looking back in history one can't help but be impressed by the parallel courses of art and science. For centuries, art and science have flourished together in geography and time but with each following it's own course. The great age of Greece, between 600 B.C. and 300 B.C., is generally viewed as a creative period of classical texts and plays. But we should recognize that while Phidias and the Greek dramatists were creating their art, Pythagoras, Socrates and Aristotle were also developing their theories and principles of science.

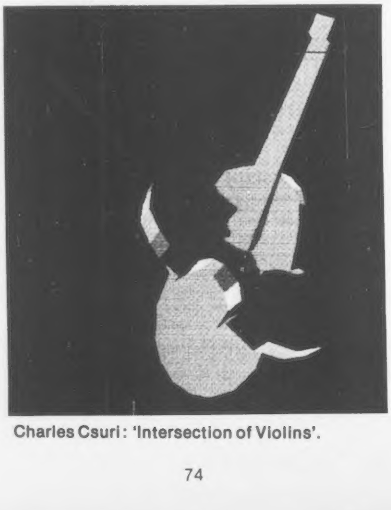

Aldo Giorgini: 'Negative Reflection'.

Another great historical period of art is, of course, the Renaissance. To most of us this period brings to mind the great Venetian sculptors and painters, the Florentines Raphael, Michelangelo, and Leonardo de Vinci, and the Northern artists of Holland and Germany. We think, too, of Shakespeare and Bacon. It is more than coincidence that this was also the Scientific Revolution. In this great period of art we find figures like Galileo and Copernicus. In the span of ten years were published the first folio of Shakespeare and the first table of logarithms.

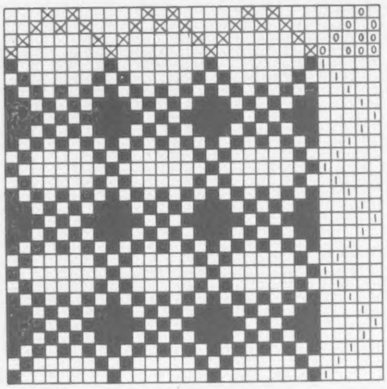
Why this parallel development of art and science? Partially because of the intense personal nature of the work of both artists and scientists. The work of an artist is a personal thing; he cannot drop his work and have it taken up by another without doing it violence. It may be odd to claim the same personal engagement for the scientist; yet in this the scientist is to the technician as the artist is to the craftsman. Remarkably, science has never flourished in an anonymous age, such as the age of medieval crafts, or in an anonymous place, such as the countries of the East.


Aaron Marcus: 'The City Sleeps, but someone is watching.'

A man becomes creative, whether he be artist or scientist, when he finds a new unity in the variety of nature. He does so by finding a likeness between things that were not thought to be alike before, and this gives him a greater sense of richness and understanding. The creative mind looks for unexpected likenesses. It breaks old traditional bonds and boundaries and fuses ideas together in new ways. This is not a mechanical procedure and it engages the whole mind in both art and science.


Charles Csuri: 'Intersection of Violins'.

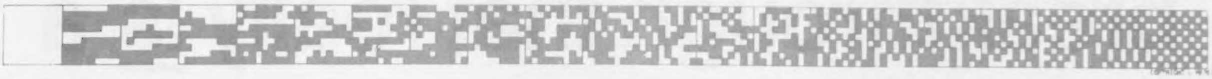
Today, both artists and scientists are forward-looking. Both fly in the face of what is established and create not what is acceptable, but what will become accepted. Interestingly, the way in which the artist looks at the world has come closer to the scientist's view. Science is becoming less preoccupied with facts than with relations, less with numbers than arrangement. This new vision, the search for structure, is also marked in modern art.


Karen Huff: Computer Weaving pattern.

## Computers and Art

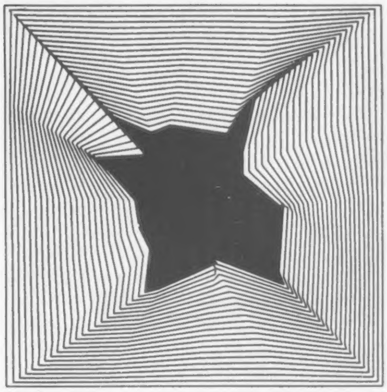
Today the computer, that prized invention of scientific and technological man, is becoming intertwined with art both as a tool and as a subject. In 1972, the deCordova Art Museum in Lincoln, Massachusetts had an exhibition of computer modules, circuits and components represented both graphically and physically. Talcott, a major computer lessor and Digital Equipment Corp. both offer their customers the opportunity to have various lithographs emblazoned on the computer and peripheral housings. But this is just scratching the surface (or should we say, painting the surface?). Much more interesting is the increasing use of the computer as a tool in creating works of art. At least one international journal, Leonardo, devotes significant space to the subject and scores of books such as Ruth Leavitt's "Artist and Computer" and

## Technology, con't...



Leslie Mezei: 'Scale of Randomness.'

Max Mathews "The Technology of Computer Music" are finding their way to market. A number of well-known museums have exhibited pieces of computer art and at least two private galleries have held "all-computer art" shows. Add to this several computer music concerts that have recently cropped up.

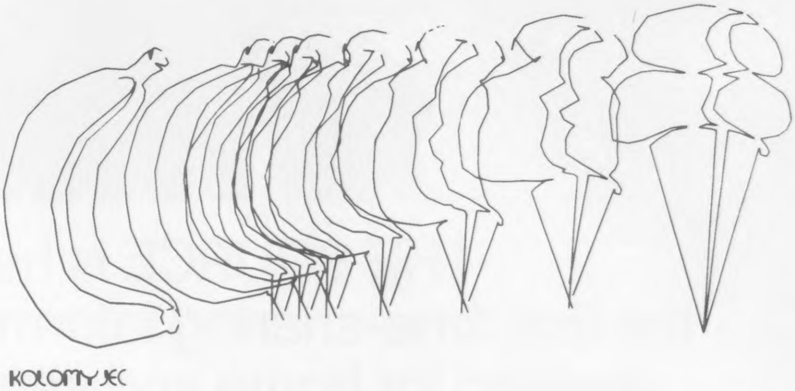


Manfred Mohr: Plastic distortion.

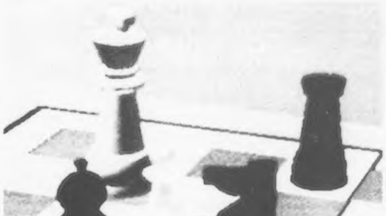
Now with the advent of personal computing, hundreds of thousands of creative people can have an unexcelled intellectual tool in their direct control. It seems likely that this could lead to a full-scale revolution in art potentially on the order of the great age of Greece or the Renaissance. It won't happen overnight or without some false starts and problems.

Perhaps the major problem today is the belief on the part of many artists and musicians that the computer is a machine that can't possibly be understood and is therefore to be avoided. Hopefully, this notion will be dispelled as more and more "non-computer" people acquire computers and as the manufacturers face up to making their products more "people-oriented."

To the extent that we can, at Creative Computing we're trying to encourage this entire process. Personally, I find it exciting to be just a small part of the dawn of what promises to be one of the golden ages of humankind.



William Kolomyjec: 'Banana Cone.'



Larry Elin: Chess set as seen by Synthavision Computer.

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2. Philadelphia Computer Music Festival. This 12" LP record contains music played on seven different computer synthesizers ranging from huge multi-channel units to small homebrew circuits. The music includes Bach, the Beatles, Pachelbel's well-known Canon and many other folk and popular melodies. ($5.95).

3. Creative Computing, September 1977 and June 1979 and ROM, October 1977. These three magazines contained 19 articles on computer art and animation along with numerous examples of computer graphics done on both large and small computers. ($6.00).

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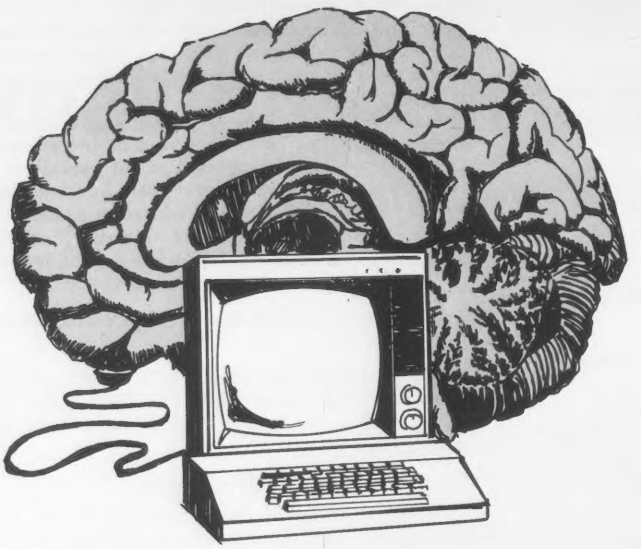


# The Controversy Goes On —

# "Can Computers Think?"

## Part III: Implementation

One of the most commonly used arguments against the view that computers can think is the claim that "Computers only do what their programs tell them to do." People, the argument goes, can think up their own ideas but computers can't. So computers can't think.

Those who feel that computers will, some day, be able to think tend to pooh-pooh this argument, saying that computers do more than what their programs tell them to. They support this claim by noting that programmers often can't predict what the programs they have written will make the computer do, that computers can learn from experience just like people and that computers can use random number generators that make their behavior basically independent of their programs.

In the last part of this three part series I want to suggest that, in spite of the objections that some people have to "computers only on what their programs tell them," the argument does have something to it. I want to show that intelligence really is (at least in part) the ability to generate one's own ideas that the computer, as it was defined by Turing in the 1930's, can't do this as well as we can. But I also want to show that the computer, as it was built in the 1940's is not subject to this limitation. We can use computers to do things that are not properly called "computations" or that aren't really "mechanical" in the ways that those terms are implicitly defined by Turing's Thesis which gives these vague intuitive terms precise meanings. And when computers are used in these ways, they come closer to thinking than do computers used in the ways we use them today.

To do all this, we need to find a precise definition of what it means to come up with an idea and to distinguish, in a reasonably precise way, the difference between learning a procedure by being programmed to carry it out and to learning it the way people learn it. (If you believe that you learn by being programmed, ask yourself two questions: "What is your programming language?", "Does your learning process resemble a computer which has been programmed?")

To see how such a precise distinction might be formulated, let us focus on an example mentioned in Part II of this series - the problem of continuing sequences, given a few initial members of the sequence. Suppose, for example, you were given the first few numbers in an infinite sequence: 2, 4, 6 and your problem is to continue it: 8, 10, 12.

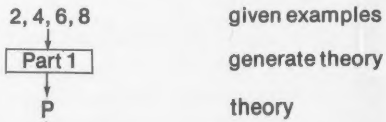
Following an idea of Solomonoff, I am going to use this as a typical example of a lot of similar tasks including these:

1. The child is given an initial set of utterances in its native language and asked to "keep talking in that language." This process is called "learning a language."
2. The scientist is given a set of observations and asked to generate a theory that accounts for those observations and more. This is called "doing science."
3. You are asked to take the two (rapidly becoming three) examples I have given and asked to develop an understanding of the concept of learning that I am trying to convey. This is called "learning to understand a concept."

We can imagine that your attempt to continue a number sequence consists of two steps. First you try to generate a rule that would produce the given members of the sequence you are trying to continue and then you try to use that rule to generate the next few members to show that you understand the principle involved. One way you might express the rule you had generated, is by a computer program that generates the sequence. Here is a program in BASIC that would do the job for the sequence beginning with 2, 4, 6, 8:

```
10 REM MY THEORY OF THE
SEQUENCE
20 LET N = 1
30 PRINT 2*N
40 LET N = N + 1
50 GO TO 30
60 END
```

Once you generated this program, (let's call it P) you could use it to generate the next 3 items in the series 10,12 and 14.



Notice that there are two things involved here - theory generation and theory application. Computers can do the application job extremely well, usually better than people can. How well can they do the generation job?

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## Controversy, con't...

Many of us think that they do it very badly indeed.

Let us look at this process again. Given the input sequence, there are several different ways of continuing it that can be described by a program. 8,8,8 is one. 6,4,2 is another. Which one is the right way? You might say that the one I gave first is, but the second one is simpler in that it takes no real computing power to generate and the third is more symmetric.

One of the things that upsets people about IQ tests is this myth that there is a right answer to this kind of question and that if, for some reason you choose one that the maker of the test did not, you cannot be very smart.

It seems to me that very much the same sort of difficulty arises in most cases in which we try to generate ideas that extrapolate from examples. There is no assured way of finding the "right" program that must have generated the sequence from the examples alone. Given any finite sequence (and the evidence on which a theory is based is always finite) there must exist an infinity of different programs that generate the part given and continue it, each program continuing it in a different way. (For the sake of this argument, as for many theoretical arguments, we ignore the practical limitations of computer size and running time.)

**The fact is that it is strictly impossible for a computation to do a good job of theory generation and this follows from the definition of a "computation."**

Let us assume that this process of continuing numerical sequence by programs adequately represents the process of generating theories. Can a computer generate such theories well?

The answer is that no, a computer cannot do a good (or even adequate) job of generating theories intelligently if it is forced to stick to simply doing computations. This is not simply the consequence of a practical limitation. It's not that we don't know enough about theory generation yet. It's not that we haven't built computers big enough or fast enough. It's not that we have the wrong kinds of programming languages. The fact is that it is strictly impossible for a computation to do a good job of theory generation and this follows from the definition of a "computation."

This definition forces a computer, doing simply computations, to be inordinately pigheaded or dumb. And this is why computers, doing "mere" computations, cannot think intelligently. (Notice that I didn't say just "computers." I'm going t suggest that computers might be able to think, but if they do, it will only be by doing something other than computations.)

Here's the definition that this conclusion follows from:

Definition: A computation is a process that proceeds step by deterministic step, as determined by a finite program, until after finite time, it gets its result at which point it prints out that result and stops.

The reason that thinking - at least if thinking includes intelligent theory generation - is beyond the scope of computation is that computations have to get a single result for a given input and then stop looking. This is fine when you are adding (say) 345 and 639. You can get both numbers into the machine completely. Then you can operate on them to produce your result, print it out and stop.

But this won't work when you are trying to compute a theory of an infinite sequence like those that we are using to represent the given data for the process of theory generation. Suppose that you were trying to develop a theory of the sequence:

2,4,6,8,10,12,14,16,18,...

You might think it's easy to read in that sequence in finite time. You just stop reading it when you've seen enough to generate your theory. But this won't work. For suppose that I tell you that after the number 1,000,000 in the sequence, comes the number 0. Doesn't this change your mind about the nature of the sequence? And do you know when to stop reading the sequence to see if you are beyond the point where things might change like this?

Of course you don't. When you are dealing with an infinite sequence of numbers like this, you cannot tell when you have seen enough of the sequence to generate a proper theory.

Although we seldom develop theories of sequences of numbers, most of our theory generation has the same general structure that this process has. The potential things to which any theory or concept that we learn might apply are, in some sense, if not infinite, at least unlimited. When, for example, we develop a theory of universal gravitation, it applies to things that we have not yet seen as well as to those that we have. When we learn a concept, such as the concept expressed by the word "dog", it applies to objects (say a chihuahua) that we may not have even imagined when we were learning the word. In the apt phrase of Oxford psychologist Jerome Bruner, such learning "goes beyond the information given." Intelligent thinking always does. And in doing so, it always takes the risk of being wrong.

**It is very tempting to see the controversy over whether or not computers can think in terms of good and bad, black and white, right and wrong.**

It is partly because people seem to hate to admit this that they take so readily to the view that general ideas can be "computed" from the evidence. They can, but when they are so computed - which is to say if we stick to them once we learn them and never even consider canging them when the evidence mounts against them - then we are not being smart. And neither is a machine that does the same thing.

The computer lacks the ability to change its mind in the face of further evidence. This isn't because there is something missing in its machinery but because there is something missing in how we use that machinery. And that something is missing not because we have failed to find it but because the definition of "a computation" excludes it.

There is, however, another kind of process that is like a computation and that also generates a theory from finite evidence in finite time but is probably not a computation. Such a procedure, which seems to have been first studied seriously by Hilary Putnam at Harvard and Mark Gold at Stanford, has been called (by Putnam) a "trial and error procedure." We can contrast it with a computation in the following way:

A computation is a process that follows a deterministic sequence of steps defined by a finite program and we count, as its result, the first thing it prints out. A trial and error procedure is driven deterministically by a finite program, exactly like a computation is. But we count the last thing that is printed out as its result. The last, not the first.

Now, the important thing is that we can prove mathematically that trial and error procedures cannot be reduced to computations and we can

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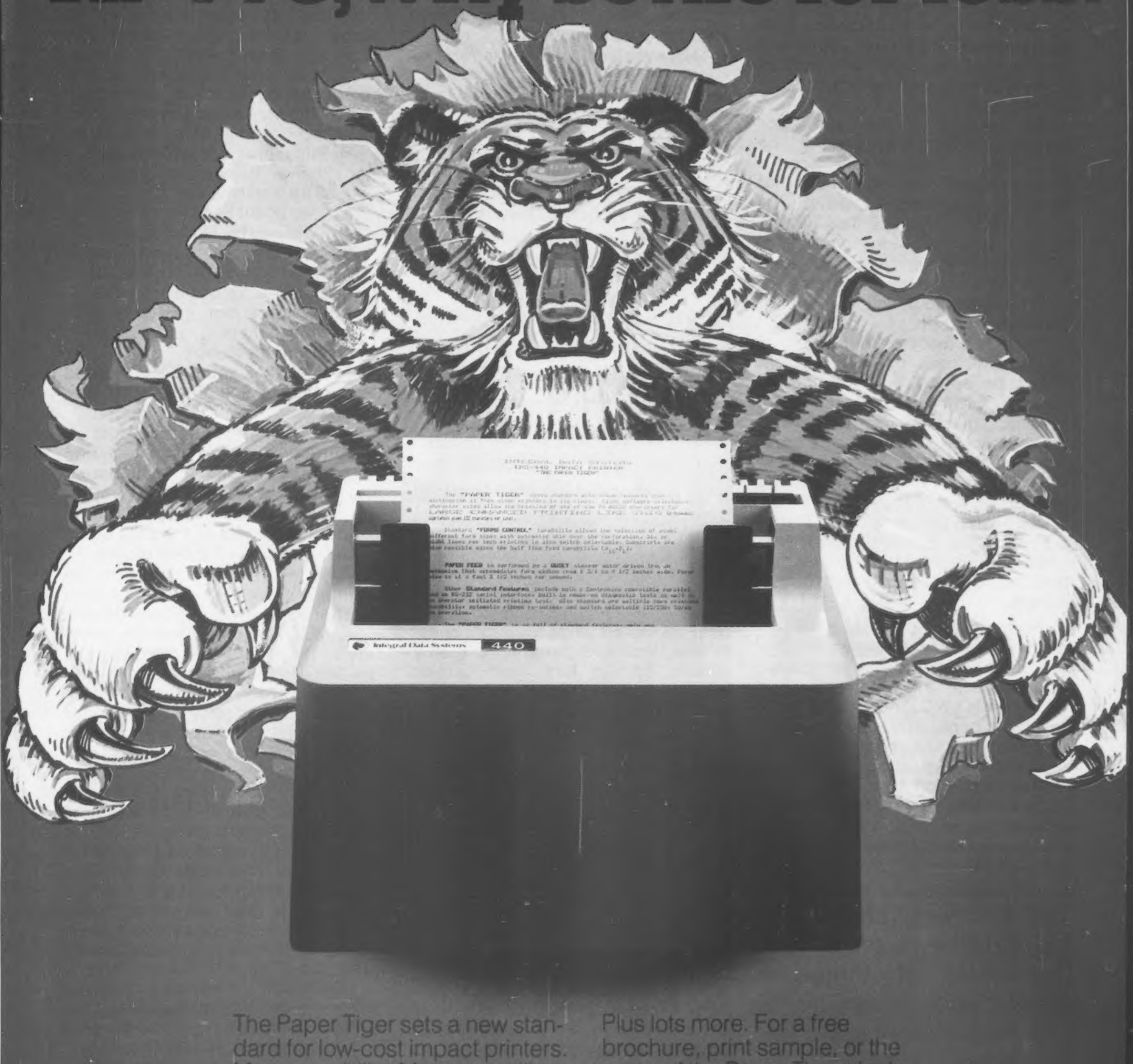

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## Controversy, con't...

also prove that trial and error procedures have many of the properties that we would like to find in the procedures by which we develop general theories from specific examples.

If this claim that intelligence involves sound theory formation is correct and it is also correct that theory formation requires a trial and error procedure, then one part of thinking (theory generation) must be beyond computing.

To see that a trial and error procedure cannot, in general, be reduced to a computation, recall a famous result from the theory of computation about the Unsolvability of the Halting Problem. The Halting Problem is the following:

Halting Problem: Given a program P and input I, determine whether or not P applied to I will or will not produce an output.

There is a theorem that says that the general case of this problem cannot be solved by a computing machine. But it is easy to see that a computing machine, using a trial and error procedure, can solve this problem. It simply starts out by printing out a "guess" that says that the program P has no output for the input I. Then it proceeds to run P on I. If, at any time, P, running on I, produces an output, it "changes its mind" and prints an indication of this fact out.

Notice that the result from this machine is produced, like a computation, in finite time. What you cannot tell in finite time is whether a given result (if it is a NO HALT result) is the **final** result or not. It is easy to see that any general purpose computer can be used to carry out such a process but the fact that such a process can be used to solve the Halting Problem proves that, when it is used in this way, it is no longer merely a computing machine.

**Trial and error procedures are much better models for the kinds of things a person does when he or she thinks than are computations.**

The use of trial and error procedures would extend the power of computers in important ways but there are good reasons why we might not want them to use such procedures. One is that most directors of computing centers would find computers, using trial and error procedures, a pain in the neck. Not only would such procedures have to be kept running forever (we would never know when they were finished), but the director would also have to keep calling the people for whom they were being run to tell them when their programs had changed their minds and produced new outputs.

Nevertheless, trial and error procedures are much better models for the kinds of things a person does when he or she thinks than are computations. If people only did computations, they would wait until they had enough information after which they would get only one shot at generating a theory. But if people used something like a trial and error procedure, they would never know. They would only think because, at any time, some new evidence might come in that would show that a theory already derived had been proved wrong and that the time had come for them to change their minds.

**There are things about thinking that Behaviorism cannot account for. There are things about thinking that Artificial Intelligence, as now constituted, leaves out. And there are undoubtedly things that the trial and error model leaves out too.**

It may be only a coincidence that we have only a single word for what seems to be two senses of "think" - the one that means "apply your intelligence" and the sense that means one is "not sure." However, the theoretical analysis that leads to the view that people work by trial and error procedures - an analysis that I have only roughly sketched here - suggests that it is no coincidence at all.

I think that intelligent thinking, when done by people, is more suitably modeled by a trial and error procedure than by a computation. Therefore, I suggest the answer to the question "Can computers think?" is both "yes" and "no." It is "no" if by a "computer" you mean a computing machine used only to do computations. It is "yes" if you allowed the computing machine to be used to carry out a trial and error procedure.

If trial and error procedures are required for intelligence, and I think they are, then trying to program computers to think is a bit like trying to develop a thinking potato. It cannot be done because neither a potato nor a computer has enough information processing power to be capable of thinking.

There is nothing new about this view. Liebnitz suggested roughly this account of the matter several centuries ago. Even Turing, who is often thought to have suggested, to that computers could think, really suggested (in his famous article about the question) that they could not. Since this fact is not widely appreciated, it may be worth quoting the words with which he said it:

> "Intelligent behavior presumably consists in a departure from the completely disciplined behavior involved in computation, but a rather slight one, which does not give rise to random behavior, or to pointless repetitive loops."

To me, that sounds like a good description of a trial and error procedure.

Now, it might not seem as though the difference between a trial and error procedure and a computation was such a big deal. But this is not so. It is a minor matter in the definition, but because it gets to the guts of the matter, it is quite a big deal indeed.

To see how small things in the definition of what we count as a computation might make a considerable difference, let's go back to the invention of the idea of the computer. At the time this idea was first dreamed up (around 1936), it was thought that a computation had to be what we today call a "total computation." A total computation is a computation that always produces an output for any input. But it was shown that a much more viable idea of a computation could be defined if one gave up this guarantee that one would always get a result if one ran a computation. This apparently minor loosening up in the definition is precisely what makes today's computer possible for there is an easy to prove "mathematical" result:

THEOREM: If the only computations are total computations, then today's completely general purpose digital computer cannot exist.

It is only when you allow computations that, from time to time, produce no results within the scope of your definition that general purpose computers become possible. It is only when you allow trial and error procedures, that thinking may become possible in a man-made artifact.

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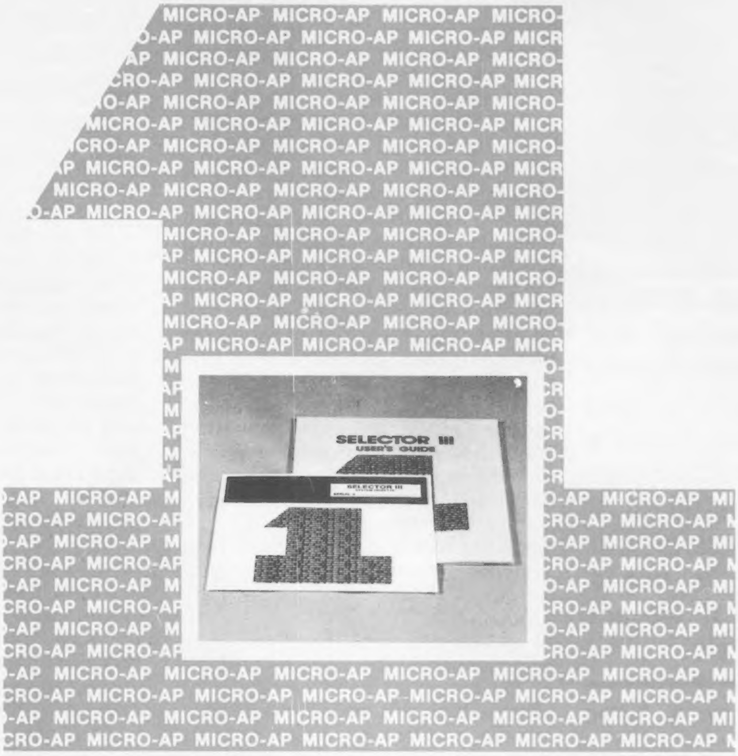

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## Controversy, con't...

The view that thinking involves the ability to carry out a trial and error procedure suggests that there may be a way out the fundamental paradox implied by the question "Can computers think?" which is so formulated that either answer ("yes" and "no") presages a minor disaster for the value of thinking. If it turns out that thinking intelligently requires trial and error procedures, then it would turn out that that device we call a "digital computer" can indeed think. But to do so, it would have to carry out a process that is not a mechanical one if we accept Turing's thesis (which almost everyone does) that identifies the intuitive idea of a mechanical procedure with the formalizable idea of a computation by a Turing machine.

**If it turns out that thinking intelligently requires trial and error procedures, then it would turn out that that device that we call a "digital computer" can indeed think. But to do so, it would have to carry out a process that is not a mechanical one if we accept Turing's thesis.**

Recall that our paradox arose because, on the one hand, saying that thinking was good implied that thinking could understand thinking and this, in turn, seemed to imply that thinking could be described by a computer program. The reason for this was that, to be able to think about thinking means that you have to have a model of it that can be applied. A model that can be applied is one whose consequences can be determined in a precise way and hence (so it seems) be computed. However, a trial and error procedure determines the course of thinking in a precise way, even though its final consequence cannot be computed. Thus thinking **can** be thought about without our necessarily being able to determine, by a computation, what its final result will be.

What we find on this horn of the dilemma is one possible solution to the problem of free will, for what a trial and error procedure does is completely determined by its present condition. There is nothing random or supernatural in it. But is outcome cannot be effectively determined (computed) by an observer - including the system that is carrying out the procedure itself. In other words, if we carry out trial and error procedures when we think, we are strictly mechanical in the narrow sense that everything that we do at a moment, m, is determined by what we were and what we had experienced at the previous moment, m-1. But, at the same time neither we, nor anybody else, can determine what we will eventually do - even if they know everything about us and had unlimited computing power available.

The trial and error model of thinking does give us a model of thinking that we can think about and thus places thinking solidly within the scope of rational thought. But at the same time, it avoids the kind of reduction to "mere machinery" that so offends some critics of the claim that computers can think. For trial and error procedures are, in a certain sense, quite unmechanical. One cannot tell, at any moment, what result they will "eventually" produce, even if one knows their program and their input, because they can always change their minds. In a sense, the result of a trial and error procedure is completely determined and it is completely determined in some finite period of time. But, from the outside, an observer cannot computer how long that period is.

On the other hand, the idea of using a trial and error procedure to solve a problem on a computer is mildly harrowing. One can imagine a computer being set up to carry out such a procedure whose eventual result was to be used to make some fundamental policy decision. After a while, the computer produces a decision. Perhaps the computer operator waits a while to see if it will change its mind, but after waiting he or she eventually forwards the result to the decision maker. The procedure has to be allowed to keep running because it still might change it's mind. Then, if it takes advantage of this possibility, the operator has to call the decision maker back later to say this so that the decision can be changed. This kind of vacillating "result" is hardly the kind of output that one wants to use as the basis for making an important decision. Thus the view that thinking requries a trial and error procedure carries with it a built-in deterrent against turning over our decision-making procedures to computer programs. What about the danger that they might take over our jobs or do our thinking for us?

Again, we have a strong, built-in deterrent. Recall that theorem of Turing's about the universal computer. If a computer could think, then we would know that any specific computing machine could think like us. But we have a theorem, due to Gold, that says that a universal trial and error machine isn't possible.

**A computer program running a trial and error procedure might come up with a theory we could not possibly understand.**

It is because computers can be universal that we can be sure that anything one computer can do, any other computer can do (given enough space and time). They can both do everything. But things are different with trial and error machines. Not every kind of theory that can be generated by one such machine can also be generated by any other. One such machine might be able to generate a batch of theories, A, and another might only be able to generate a different batch, B.

If we program the computer to run some given trial and error procedure, and even if we know that our program has no bugs in it, we still can't be sure that it will think like us. Thus there is very little temptation to turn over to such machines tasks requiring human judgement. Computers (using trial and error procedures) might think and we might think, but we might both think differently...so differently that we could not even understand each other.

From a practical point of view, of course, we were already faced with this problem when we thought that thinking could be represented by a computer program because, as Weizenbaum and many other have observed, we can't just look at a computer program and understand what it will do. But now, with trial and error procedures, we have it not only for the process, but even for the result produced. A computer program running a trial and error procedure might come up with a theory we could not possibly understand.

Could we program a computer to learn exactly the way we do so that ths sort of thing would not happen? Perhaps we could, and this is where the "maybe" answer to the question "Can computers think?" comes in. But if we did, we might, it appears, find ourselves having to bring up the computer in much the way that we

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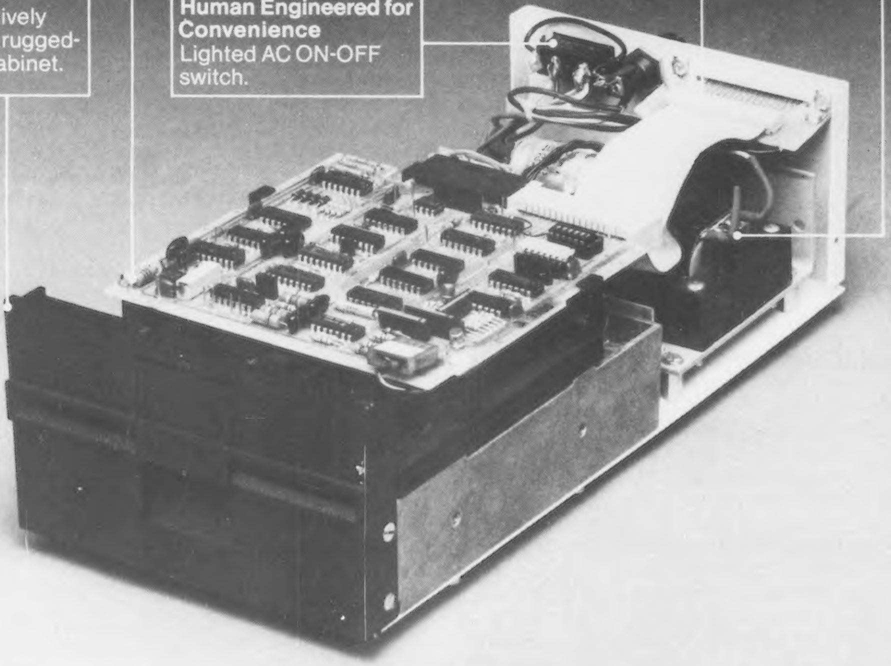

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## Controversy, con't...

bring up a child because that program would have to learn its first few theories the same way we do. And in doing this, we might end up dealing with our computer programs the way we now deal with people.

And all the trouble we would have with that bloody computer we were bringing up might remind us of that old joke about the fact that the human being is the only computer that can be produced by unskilled labor. We might just decide to drop the idea of using a thinking machine to work for us and stick to people.

**We can use computers to do things that are not properly called "computations" or that aren't really "mechanical" in the ways that those terms are implicitly defined by Turing's Thesis which gives these vague intuitive terms precise meanings.**

Thus, there are some appealing consequences to settling the "Can computers think?" controversy by saying that computers can think only when they act like trial and error machines. For one thing, it seems to give both sides of the controversy, as it is currently laid out, some credit for rationality. Both are partly right.

It is very tempting to see the controversy over whether or not computers can think in terms of good and bad, black and white, right and wrong. One side (you pick which one) has all the good guys (wearing the traditional white hats) and the other has all the bad guys (with the black hats and unshaved faces). The good guys may lose some of the battles but, in the end, there will be a shootout and the good guys will win. The situation is actually much less polarized than that. There are good guys on both sides and both sides of the controversy have things going for them.

One can look at the argument about the question "Can computers think?" as being basically an argument over what kind of a model to use for the human mind. And one can then grant that, since we all know that models are not the same as the thing modeled, that simple models are alright. They explain some things and the simpler the model, the easier it is to deal with. So one would always try to do one's theorizing about the mind in terms of the simplest models one can get away with. But, at the same time, one should also always be ready to admit the possibility that a simple model might not cover all of thinking.

The desire to work with as simple a model as possible is surely one of the things that motivated the British Empiricists like Locke and Hume, who, in the 18th Century, tried to give very simple accounts of thinking. One of the things that they were trying to get out of the accounts of thinking was God, who, by all accounts, is A Very Complicated Machine Indeed. The trouble with using God on your explanations of thinking is that it is probably harder to understand what your explanation of thinking is than what it is that you are explaining. And your explanation gets to be so vague and convoluted that you can bring in all kinds of extra paraphernalia, like the Divine Rights of Kings, without anybody noticing.

Let us imagine that there is a hierarchy of machine types, each slightly more complicated and powerful than the type before it. At the top of the line, sits God, the Cadillac of information processing machines. At the bottom sits that Moped of information processing machines, the cuckoo clock. Somewhere along the middle of the line sits the digital computer and then, slightly above it, the trial and error machine.

There are mathematical results that tell us that machines like the cuckoo clock are easier to understand than computing machines and these, in turn, are easier to understand than trial and error machines. It makes sense to try to use the simplest type of machinery in this hierarchy that we can use to explain thinking. If we succeed with a simple machine, we gain a lot. The simpler the machinery we use in the explanation, the easier the explanation is to understand.

The work of the Behaviorist, which tries to model the mind in terms of machines that computer theorists call "finite automata," gives us some insights into certain (very limited) kinds of human behavior. These insights are useful but they are based (as any scientific results are based) on a partial model.

The work of Artificial Intelligence, which tries to model the mind in terms of the kind of machine that the theorists call "computers" or "Turing machines," allows us richer insights in terms, however, of theoretical constructs that are harder to understand. Try to really understand some of the programs that have been written in this area and you will see what I mean. Still, this work gives us an enormous amount of insight into thinking. To my mind, it has done more in the last 30 or so years to give us such insights than all of behaviorism.

But the work in Artificial Intelligence still falls short of providing an adequate model, even of the very limited information processing input-and-output kind, of the thinking process. For a more adequate model, we need to turn to even more powerful machinery of the kind that we have been calling "trial and error" machines.

One can admit that one learns something at each of these levels without criticizing either those who study thinking with more powerful machinery or those who study it using less powerful machinery than the kind we happen to prefer.

None of the work on the theory of thinking is particularly offensive in what it tells us about thinking. It becomes offensive when it says that "What we are looking at is all there is." There are things about thinking that Behaviorism cannot account for. There are things about thinking that Artificial Intelligence, as now constituted, leaves out. And there are undoubtedly things that the trial and error model leaves out too.

**In the apt phrase of Oxford psychologist Jerome Bruner, such learning "goes beyond the information given." Intelligent thinking always does. And in doing so, it always takes the risk of being wrong.**

That is what scientific models always do. They always leave something out. That is why the "Can machines think?" controversy, which has lasted for more than 2000 years, will continue. Every machine model that has been proposed for human thinking has accounted for some aspects of thinking and left others out.

It may be worth, remembering that today's general purpose digital computer was dreamed up when people asked what the, then current, theory of computation left out. Models, (and the theories they support, are fine as far as they go. The computer is certainly far and away the most exciting model we have ever had for human thinking.

But it was not the first such model and it won't be the last. ☐

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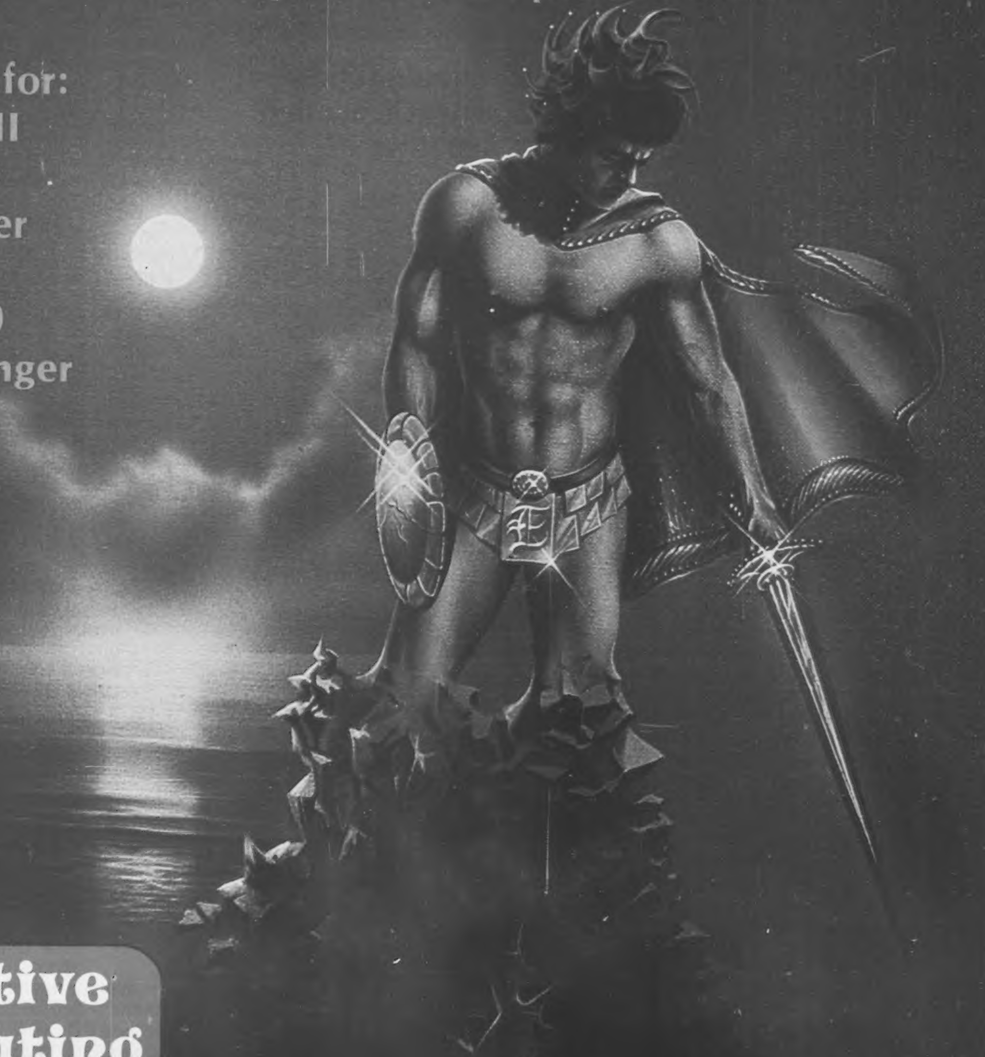
Over 200 programs on 70 tapes and disks



Software for:
- Apple II
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- PET
- SOL-20
- Challenger
- CP/M

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## Contents

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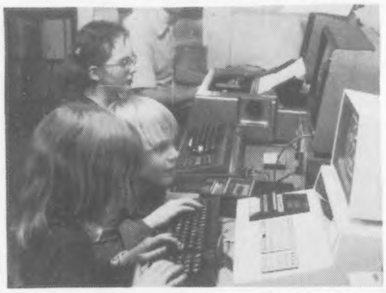
* * *



Creative Computing educational programs are thoroughly tested by children and teachers before being released.

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In addition to the magazine, book service and software cassettes and disks, Creative Computing has also been involved in producing custom software. Many of you have seen the article in Creative Computing telling about our involvement in the Sesame Place Project. We are now working on developing a series of educational interactive games for children to be used in these centers. Creative Computing has taken a leading role in this new approach to the use of micro-computers in the educational field.

Our software department has also performed consulting and software development for such organizations as Tandy Corporation, The Tuckahoe School System, and The Franklin Institute Museum, Philadelphia. This involvement in a growing number of state-of-the-art projects assures you of the absolute best in software.

If you would like us to submit a bid on custom software for your organization, please contact Creative Computing Consulting.

* * *

## Warranty

We warrant to the user of Creative Computing Software that it is free from defective materials and workmanship. We warrant that the programs will load and run on the standard manufacturer configuration of the computer listed. If the product proves unsatisfactory, it will be replaced if returned to the address below. The product will not be replaced if it has been damaged or erased by the user. **Manufacturer, distributor, and seller shall not be liable for consequential commercial damages.**

We cannot guarantee that software will run in non-standard configurations, with "foreign" peripherals, or with more or less memory than specified. For example:

- 8K PET programs may not run in larger PETs.
- TRS-80 Adventure, Ultra Trek, and other machine language programs on cassette may not run under TRS DOS.
- CP/M disks will not run on Ohio Scientific CP/M.

* * *

## Inquiries

Inquiries should be in writing and accompanied by a self-addressed stamped envelope for your reply. They should be addressed to:

Creative Computing
Software Development Center
P.O. Box 789-M
Morristown, NJ 07960

We are **not** prepared to answer telephone inquiries about our software. The Software Development Department is in a separate building and cannot be reached over the listed Creative Computing telephone numbers.

# Adventure

## A New Type of Game

Welcome to an astonishing new experience! **ADVENTURE** is one of the most challenging and innovative games available for your personal computer. This is not the average computer game in which you shoot at, chase, or get chased by something, master the game within an hour, and then lose interest. In fact, it may take you more than an hour to score at all, and will probably take days or weeks of playing to get a good score. (There is a provision for saving a game in progress).

This game was inspired by the huge Adventure game which has appeared on large mainframe computers the last several years. But there are important differences. Not only will **ADVENTURE** fit into a relatively small computer, but the 'interpreter' is designed so that different Adventures can be created by changing the data base. So look for more Adventures in the future...

In playing the game you wander thru various 'rooms' (locations), manipulating the objects there to try to find 'treasures'. You may have to defeat an exotic wild animal to get one treasure, or figure out how to get another treasure out of a quicksand bog. You communicate thru two-word commands such as 'go west', 'climb tree', 'throw axe', 'look around'.

## Six Different Adventures

**ADVENTURELAND** (by Scott Adams) - You wander through an enchanted world trying to recover the 13 lost treasures. You'll encounter WILD ANIMALS, MAGICAL BEINGS, and many other perils and puzzles. Can you rescue the BLUE OX from the quicksand? Or find your way out of the maze of pits? Happy Adventuring.....

| | |
|---|---|
| CS-3007 TRS-80 16K Level II (Machine language) | $14.95 |
| CS-3506 TRS-80 32K Disk (Includes Pirate Adventure) | $24.95 |
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| CS-5003 SORCERER 16K (Machine language, available Nov.) | $14.95 |
| CS-9003 8" CP/M 48K Disk (Includes Pirate Adventure In Microsoft Basic | $24.95 |

**PIRATE ADVENTURE** (by Scott Adams) - "Yo Ho Ho and a bottle of rum..." You'll meet up with the pirate and his daffy bird along with many strange sights as you attempt to go from your London flat to Treasure Island. Can you recover LONG JOHN SILVER's lost treasures? Happy sailing matey.....

| | |
|---|---|
| CS-3008 TRS-80 16K Level II (Machine language) | $14.95 |
| CS-3506 TRS-80 32K Disk (Includes Adventureland) | $24.95 |
| CS-1009 PET 24K (Includes Adventureland. In Basic) | $14.95 |
| CS-5004 SORCERER 16K (Machine language, available Nov.) | $14.95 |
| CS-9003 8" CP/M 48K Disk (Includes Adventureland. In Microsoft Basic. | $24.95 |

**ORIGINAL ADVENTURE** (by Crowther, Woods, Manning and Roichel) - Somewhere nearby is a collosal cave where others have found fortunes in treasures and gold, but some who have entered have never been seen again. You start at a small brick building which is the wellhouse for a large spring. You must try to find your way into the underground caverns where you'll meet a giant clam, nasty little dwarves, and much more. **This Adventure is Bi-Lingual**—you may play in either **English or French**—a language learning tool beyond comparison. Runs in 32K CP/M system (48K required for SAVE GAME feature). Even includes SAM76 language in which to run the game. The troll says "Good Luck."

| | |
|---|---|
| CS-9004 8" CP/M 32K Disk | $24.95 |

**MISSION IMPOSSIBLE ADVENTURE** (by Scott Adams) - Good Morning, Your mission is to... and so it starts. Will you be able to complete your mission in time? Or is the world's first automated nuclear reactor doomed? This one's well named, its hard, there is no magic but plenty of **suspense**. Good luck.....

| | |
|---|---|
| CS-3009 TRS-80 16K Level II (Machine language) | $14.95 |
| CS-3507 TRS-80 32K Disk (Includes Voodoo Castle) | $24.95 |
| CS-5005 SORCERER 16K (Machine language, available Nov.) | $14.95 |

**VOODOO CASTLE** (by Scott Adams) - Count Cristo has had a fiendish curse put on him by his enemies. There he lies, with you his only hope. Will you be able to rescue him or is he forever doomed? Beware the Voodoo Man.....

| | |
|---|---|
| CS-3010 TRS-80 16K Level II (Machine language) | $14.95 |
| CS-3507 TRS-80 32K Disk (Includes Mission Impossible) | $24.95 |
| CS-5006 SORCERER 16K (Machine language, available Nov.) | $14.95 |

**THE COUNT** (by Scott Adams) - You wake up in a large brass bed in a castle somewhere in Transylvania. Who are you, what are you doing here, and WHY did the postman deliver a bottle of blood? You'll love this Adventure, in fact, you might say it's LOVE AT FIRST BITE.....

| | |
|---|---|
| CS-3011 TRS-80 16K Level II (Machine language, available Nov.) | $14.95 |

**To order**, send payment plus $1.00 shipping or bankcard number to **Creative Computing Software**, P.O. Box 789-M, Morristown, NJ 07960. Or call toll-free **800/631-8112** (In NJ 201/540-0445).

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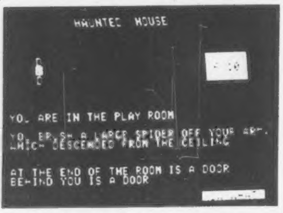
**Apple II** Adventures coming in early 1980!

## Haunted House, CS-4005 (16K)



HAUNTED HOUSE

YOU ARE IN THE PLAY ROOM

YOU BRUSH A LARGE SPIDER OFF YOUR ARM, WHICH DESCENDED FROM THE CEILING

AT THE END OF THE ROOM IS A DOOR
BEHIND YOU IS A DOOR

It is 6:00 and you have until midnight to find the secret passageway out of a haunted house. During your search, you may find skeleton keys to open locked doors, good luck charms, friendly ghosts, evil spirits, and skeletons. The sound effects (creaking doors and stairs) add to the eeriness. The house layout changes in every game.

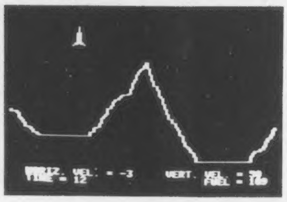
## Space Games-1, CS-4001 (16K)

### 1. Saucer Invasion

We're being invaded by aliens from another planet. Your mission is to destroy as many saucers as possible with 15 missiles. Use the game paddle to move the launch tube back and forth across the bottom of the screen, then fire with the paddle button. A two stage missile boosts slowly, firing its warhead midway toward the target. The flying saucers fly at different speeds and altitudes, so luck and timing are crucial! High resolution graphics, exploding saucers and wild sound effects make full use of the APPLE capabilities.

### 2. Rocket Pilot

Rocket Pilot is an advanced real time take off and landing game. The object is to maneuver your spaceship successfully over a mountain to the landing area on the other side. The game paddles control your horizontal and vertical thrusters. In addition to the graphics display of the rocket, the screen also shows your current velocity, time, and remaining fuel. Earn a rating of "rocket pilot" if you negotiate the trip without running out of fuel or crashing into the mountain.

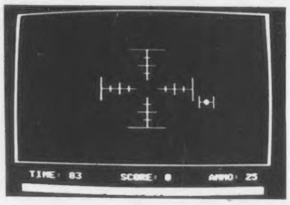


### 3. Dynamic Bouncer

Watch a ball move through a maze of colorful, changing obstacles in this creative graphics demonstration.

### 4. Star Wars

Use the game paddles to get the enemy TIE fighters within your crosshairs, then FIRE!! The object is to destroy as many enemy ships as possible in 90 seconds as they perform evasive maneuvers to avoid your fire.



Lasers, exploding enemy fighters, and action sounds put you in the middle of the fierce battle against the Imperial Empire!

## Sports Games-1, CS-4002 (16K)

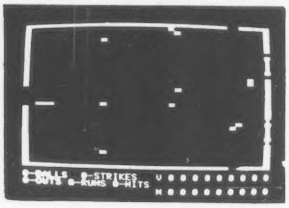
# BATTER UP

**creative computing software**

Take the field. Mix up your pitches to keep the batter off balance. If he hits it, move your fielders to snag the ball before he gets to first. Balls and strikes double plays, force outs and errors. It's the great American computer game.

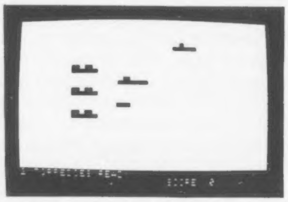
### 1. Baseball

Play in the APPLE World Series! This two-player game is played according to Major League rules. Game paddles control the infielders and outfielders, as you pitch changeups, fastballs, sliders, curves or knuckleballs. When you're at bat, good timing is the key as you swing the bat with a tap on the space bar. This exciting graphics game even includes stealing, double plays, and sacrifices under computer control.



### 2. Torpedo Alley

The object of Torpedo Alley is to sink as many ships as possible with your forward torpedo tubes. Move into position and FIRE!! But don't waste a shot—it takes time to reload when the tubes are empty. Targets include aircraft carriers, patrol boats, destroyers, and cargo ships. Depending on your score, you earn the rank of cook, seaman, or captain. How many stripes for you?



### 3. Slalom

Have fun skiing without getting cold! Slalom is a downhill exercise in which you weave in and out of the flags on a championship slalom course. Game paddles control the speed and motion of the skier as you go for Olympic gold. But don't knock down any flags or go off the mountain. Swiss hospitals don't take Master Charge!

### 4. Darts

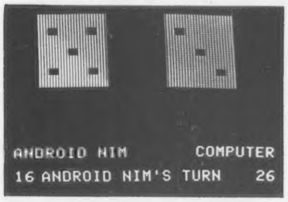
How's your aim? Play darts and find out. You have six darts to throw at a dartboard. The game paddles control the position of the darts. Can you hit the Bullseye?

## Strategy Games-1, CS-4003 (16K)

### 1. Checkers

(Requires Applesoft or Applesoft II BASIC)

This is the APPLE version of the popular board game, with color graphics. Test your strategy against the computer. The computer does not look ahead for future moves, hence it is best suited for beginning players.



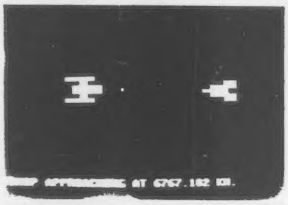
```
ANDROID NIM          COMPUTER
16 ANDROID NIM'S TURN      26
```

### 2. Skunk

Skunk is a two player dice game in which the object is to accumulate 100 points before your opponent. On each turn you may roll the dice or "pass." You roll the dice by turning a game paddle, and the value of the roll is added to your total score. If you roll a 1, you lose all the points accumulated on that turn. If you roll snake eyes (two 1's), your total score goes to 0.

### 3. UFO

You are the captain of a space ship carrying the last remnants of the human race, after a space war with another planet in which both worlds were destroyed. The aliens have launched a similar vessel and will attempt to destroy your ship. On each move you decide whether to maneuver, halt for repairs, or fire from your arsenal of heavy guns, warheads and lasers.



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APPROACHING AT 6767.182 KM.
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### 4. Blockade

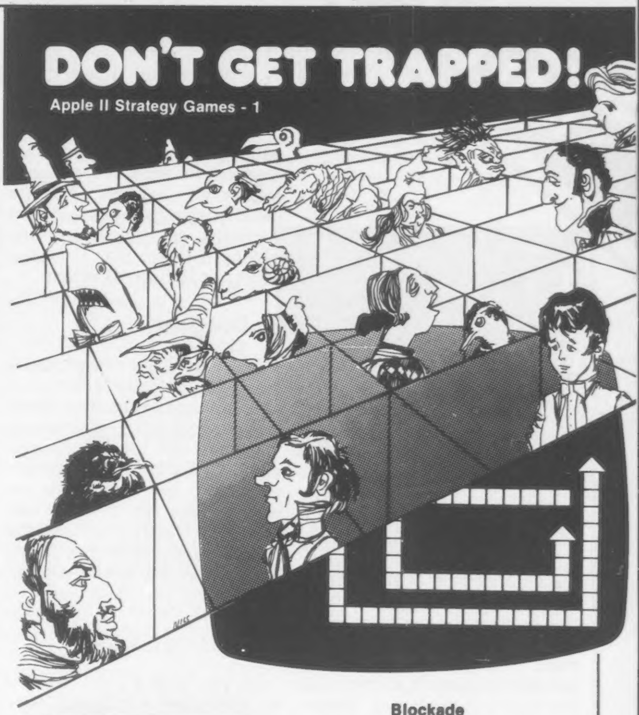
In this game, each player controls a colored marker which leaves a trailing path. The object is to keep your marker in motion longer than your opponent by not running into a wall, the other player's path, or crossing your own path. Direction is controlled on the keyboard, but you can't stop moving. Game options include one or two player games, and accelerated speeds which increase as the game progresses.

### 5. Genius

In each round of this game, you are given a potpouri of 5 trivia questions to answer as quickly as possible. Any final score above 400 will merit a rating of genius, but watch out! There's a 25 point penalty for each wrong answer. The quiz includes questions about movies, sports, TV, literature, general knowledge, and of course, computers.

DON'T GET TRAPPED!

Apple II Strategy Games - 1



creative computing software

**Blockade**

Trap your opponent before he traps you. Control a moving wall until your opponent can't move. Options to speed up and play against the computer. Complete with sound effects.

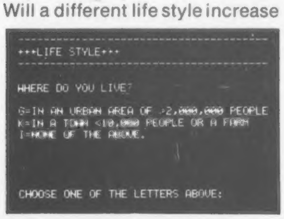
---

## Know Yourself, CS-4301 (16K)

The programs in this series aren't games, but they are fun to use. All of them are based on statistically valid tests and data. Using them from time to time could help you see in what direction your life is progressing.

### 1. Life Expectancy

Do you ever wonder how long you will live? Take the Life Expectancy quiz and find out! Will a different life style increase your life expectancy? Will following all the advice in the National Enquirer really help?



```
-----------------------------------
+++LIFE STYLE+++
-----------------------------------

WHERE DO YOU LIVE?

G=IN AN URBAN AREA OF >2,000,000 PEOPLE
K=IN A TOWN <10,000 PEOPLE OR A FARM
I=NONE OF THE ABOVE.



CHOOSE ONE OF THE LETTERS ABOVE:
```

### 2. Psychotherapy

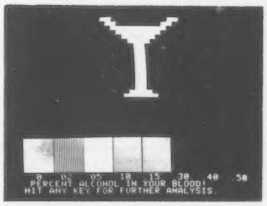
The APPLE analyst asks you 20 questions to help you decide if you might benefit from a psychotherapist. Psychotherapy asks you about your feelings, actions, and phobias and compares them against population norms. Here's where you can talk freely about those special powers people are using against you. With sound. For all computer freaks.

### 3. Computer Literacy

Are you a computer whiz? Try this quiz and find out how much you know about computers and computing. On each round, answer 5 questions as quickly as possible. Depending on your score, you will be rated from janitor to a systems analyst. Questions range from history to present technology and applications. A large number of questions ensures variety on each round.

### 4. Alcohol

Are you a lush? Do you like to hide your Ripple in a Grape Nehi bottle? Alcohol allows you to experiment with the relationship between drinking, the alcohol level in your blood, and its effects on your behavior. Enter parameters such as body weight, time spent drinking, type of beverage and number of drinks. Sound and graphics—even a bubbling champagne glass!—make Alcohol fun as well as informative.

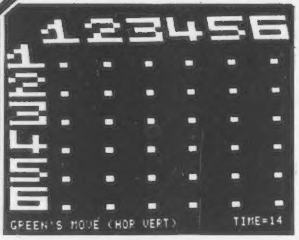


```
 0   02   05   10   15   30   40   50
PERCENT ALCOHOL IN YOUR BLOOD!
HIT ANY KEY FOR FURTHER ANALYSIS.
```

### 5. Sex Role

Are you androgynous? This program helps you to examine your nature, behavior and attitudes in light of society's changing concept of sex roles.

## Brain Games-1, CS-4004 (16K)



```
 123456
1
2
3
4
5
6
GREEN'S MOVE (HOP VERT)      TIME=14
```

### 1. Nuclear Reaction

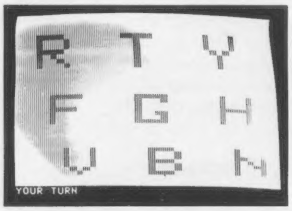
Nuclear Reaction is an exciting strategy game for two players. Each player, in turn, places a particle of radioactive material on a 6x6 board. When the number of particles at a location reaches its critical mass, it explodes, sending a particle to adjacent squares. As the board fills up, a single explosion can cause long chain reactions. The object of the game is to cause the right chain reaction to wipe out all your opponent's pieces. Nuclear Reaction is a game of skill, fast decisions, and quick reversals, making it fun to play for many hours. Action sound effects.

### 2. Dodgem

In Dodgem, two sets of pieces move at right angles across a checker style board. The object is to move all your pieces across the board and off the opposite edge. One player moves from the bottom to the top while the other moves left to right. You may play Dodgem against the APPLE or a friend. Six board sizes and action sound effects.

### 3. Dueling Digits

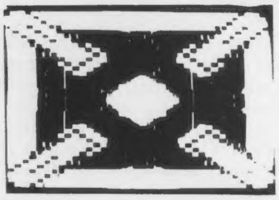
Do you have a good memory for sequences of numbers? Play Dueling Digits and find out. In this game, the computer presents a digit and tone, then erases it. You then type in the same digit. After each turn, the computer repeats all the previous digits and adds a new one, and you try to type in the entire sequence. The round is over when you make four mistakes. For up to four players. Two skill levels.



```
R  T  Y
F  G  H
V  B  N
YOUR TURN
```

### 4. Parrot

Parrot is similar to Dueling Digits, but you try to remember sequences of letters and tones instead. Two skill levels.



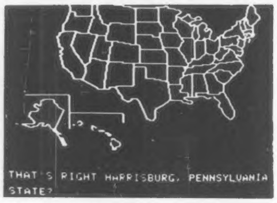
### 5. Midpoints and Lines

These two colorful graphics demonstrations will run continuously. Great for store displays, parties, and showing off your computer.

### 6. Tones

This program allows you to make your own music and sound effects with the game paddles. One paddle controls the pitch of the tone, the other controls the duration. No special hardware is required.

## CAI Programs, CS-4201 (16K)



```
THAT'S RIGHT HARRISBURG, PENNSYLVANIA
STATE?
```

### 1. U.S. Map

Do you have problems remembering which state is which? Do you know the capitals? After a few games of U.S. Map, you should have no trouble. This advanced application of APPLE high resolution graphics enhances interest in the learning process. Options allow you to choose whether to identify only the state or both the state and its capital. As the run progresses, missed states or capitals are repeated several times.

### 2. Spelling

(Requires Applesoft or Applesoft II BASIC)

Do you need practice spelling? Let APPLE's Spelling program lend a hand. You are shown a word and asked to spell it when it disappears. Grades from A+ to F are given depending on how many you get correct. The better you are, the shorter the time you see the hint word.

### 3. Math Drill

How are your math skills? Let Math Drill help you improve them. You can choose the type of problem you wish to practice—addition, subtraction, multiplication, division or mixed. You may also choose large or small numbers, whether or not to have a time limit, and how long the limit is to be.

```
8 + 1 = 9
WOW!!!
```

### 4. Add With Carry

Here is a program to help you with harder addition. You are presented with a series of addition problems of increasing difficulty. You add one column at a time, filling in the column sum and then the carry amount. If you do well, the problems get harder, if you don't, they get a little easier.

## Apple Software on Disks

Now, Creative Computing offers its cassette software of floppy disks. These are not just the same programs stored on a disk but enhanced, menu driven libraries for the ultimate in ease of use. The machine language programs have been relocated to run with your disk system, and even Applesoft programs are loaded and executed automatically. Make the most of your APPLE with Creative Computing floppy disk software.

**SPACE AND SPORTS GAMES CS-4501**

Rocket Pilot
Saucer Invasion
Star Wars
Dynamic Bouncer
Baseball
Torpedo Alley
Slalom
Darts

**CAI PROGRAMS AND KNOW YOURSELF CS-4503**

U.S. Map
Spelling
Math Drill
Add-With-Carry
Life Expectancy
Psychotherapy
Computer Literacy
Alcohol
Sex Role

**STRATEGY AND BRAIN GAMES CS-4502**

Checkers
Skunk
UFO
Blockade
Genius
Nuclear Reaction
Dodgem
Dueling Digits
Parrot
Midpoints
Lines
Tones

**SORCERER**

5
Sorcerer
Adventures
See page 3
©

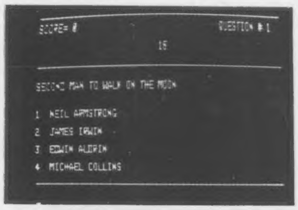
## Smart Alec, CS-5002 (8K)

Smart Alec is fun as well as educational. Test your memory by answering five multiple-choice questions on each round. Each question has a time limit and you are penalized 25 points for a wrong answer. Your score is based on how long it takes you to get the correct answer. If you do well, the computer will certify you as a genius.

There are seven areas in which to test your expertise. They are:

1. Science
2. Geography
3. History
4. Computers
5. T.V. and Movies
6. English
7. Trivia

Over 200 questions in all!

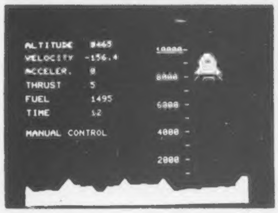


```
SCORE= 0                          QUESTION # 1
                   15

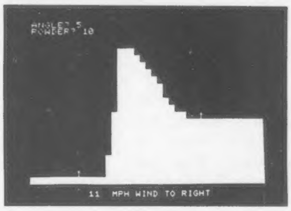
SECOND MAN TO WALK ON THE MOON

1  NEIL ARMSTRONG
2  JAMES IRWIN
3  EDWIN ALDRIN
4  MICHAEL COLLINS
```

## Graphics Games-2, CS-5001 (8K)



```
ALTITUDE    8465        10000-
VELOCITY   -156.4
ACCELER.    0            8000 -
THRUST      5
FUEL        1495         6000 -
TIME        12
                         4000 -
MANUAL CONTROL
                         2000 -
```



```
ANGLE? 5
POWDER? 10

        11  MPH WIND TO RIGHT
```

### 1. LEM

In this graphic version of the popular real time lunar landing game you must land on the moon's surface with the lowest possible velocity. You can control the thrust of your retro-rockets with the number keys but you have a limited amount of fuel. The automatic pilot option can be activated and deactivated with the keyboard. You take a walk on the moon and plant a flag if you land successfully.

### 2. Pie Lob

This is a game in which two players lob pies at each other across a computer-generated hill. You choose the angle and the strength of the throw and then watch the trajectory of the lob across the screen. The computer changes the terrain and the wind speed in each game. Pie Lob makes good use of SORCERER's graphics.

### 3. Nuclear Reaction

Nuclear Reaction is an exciting strategy games for two players. Each player, in turn, places a particle of radioactive material on a 6x6 board. When the number of particles at a location reaches its critical mass, it explodes, sending particles to adjacent squares. As the board fills up, a single explosion can cause long chain reactions. The object of the game is to cause the right chain reactions to wipe out all your opponent's pieces. Nuclear Reaction is a game of skill, fast decisions, and quick reversals, making it fun to play for many hours.

### 4. Bounce

Bounce is an intriguing graphics demonstration which traces the path of a ball as it bounces around the screen.

### 5. Checkers

The SORCERER matches its strategy against yours in this popular game. The computer does not look more than one move ahead, hence the game is best suited for beginning players.

### 6. Dodgem

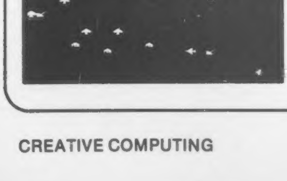
Dodgem is played on a checker-type board against the computer or another player. The object of the game is to block your opponent to slow him down. One player moves pieces from the bottom of the board to the top, and the other player moves from left to right, trying to get all the pieces off the board. This is a challenging game of strategy.

**CHALLENGER**

## Graphics Games-3, CS-6001 (8K)

### 1. Tank Attack

Maneuver your tank around trees, houses and airplanes to destroy enemy guns. The guns fire back, and sometimes you get the distinct impression you have been lulled into a sense of security before getting blown up. A challenging real time game written by one of our most vicious programmers.



### 2. Dodgem

Dodgem is played on a checker-type board against the computer or another player. The object of the game is to block your opponent to slow him down. One player moves pieces from the bottom of the board to the top, and the other player moves from left to right, trying to get all the pieces off the board. A challenging strategy game.

### 3. Free For All

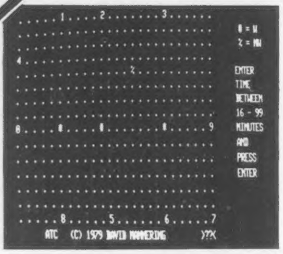
This game started as a joke, but it's for real! Two people compete against each other and the computer. A submarine, a destroyer, and a plane, criss cross the screen. Each may fire at the others. Free For All makes extensive uses of the Challenger's graphics.

### 4. Hidden Maze

In this game, two players (you, and the computer or a friend) compete to be the first to reach the opposite side of the maze. The maze is hidden at first and is only revealed as you run into parts of it. Swinging gates add an additional challenge to this game of memory and skill

TRS-80 LEVEL II

## Air Traffic Controller, CS-3006 (16K)



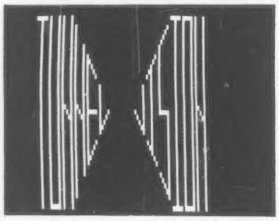
```
ENTER
TIME
BETWEEN
16 - 99
MINUTES
AND
PRESS
ENTER
ATC  (C) 1979 DAVID MANNERING      >??K
```

This real time machine language program puts you in the chair of an air traffic controller. There are 27 airplanes—jets and prop planes—which must be controlled as they land, take off and fly over your air space. You give the orders to change altitude, turn, maintain a holding pattern, clear for approach, and land at your two airports. This realistic simulation includes navigational beacons, and requires planes to take off and land into the wind. Air Traffic Controller was written by an air traffic controller and is a favorite of the Creative Computing staff!

## Strategy Games, CS-3005 (16K)

### 1. Tunnel Vision

Tunnel Vision gives an exciting visual twist to the popular maze game. You are transported into a massive labyrinth and must find the exit or be lost forever. A mouse's eye view is displayed as you wander through the maze, seeing walls, turn-offs, and dead ends as they are encountered. This is an excellent example of three dimensional perspective using TRS-80 graphics.



### 2. Evasion

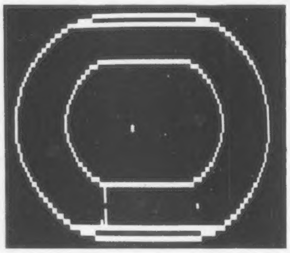
In this real time game, you are pursued around the game board by an evil-looking snake. The arrow keys control your small drone as it tries to avoid being bitten for as long as possible. (Evil-looking snakes always catch their drones.) Variations of play include two different speeds and hyper-jumps which randomly relocate you on the board. Looking for an escape? Try Evasion.

### 3. Jigsaw

Jigsaw is a computer-age puzzle game making extensive use of TRS-80 graphics. The computer generates a random puzzle and puzzle board. Using a combination of deductive reasoning and luck you must fit the graphically represented puzzle piece into place. Jigsaw has four different options featuring concealed pieces and helpful clues.

### 4. The Masters

Are you a wandering pro or just a Sunday golfer who would like to keep in practice? Each hole is graphically depicted from tee to green. You choose a club for your next stroke—wood, iron, or sand wedge. Once you're on the green, a worm's-eye view is displayed for putting.



### 5. Motor Racing

Motor Racing combines real time racing action with advanced graphics functions. You racing car may be driven on two skill levels. The first allows only for directional control on a simple track, while the second skill level offers a choice of professional tracks, the Indianapolis Speed Way or a road race course. The graphics and animation make Motor Racing fun to watch as well as play.

## Board Games-1, CS-3001 (16K)

### 1. Mugwump

Mugwump is a board games which uses a 10x10 grid on which four friendly Mugwumps are hiding. Your mission is to locate these mysterious animals and capture them. You input X and Y coordinates for each move and after each round the distances from each mugwump are displayed. What is a mugwump? No one really seems to know, but if you find one, maybe you'll let us in on the secret.

### 2. Flip Disc

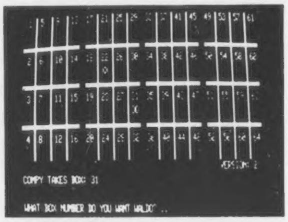
Are you an Othello freak? Do you wish there were someone who would provide you with a challenging game at a moment's notice? Flip Disc is a program which will turn your computer into an excellent opponent. Flip Disc provides the game board, chips, and handles all playing functions. Three different skill levels, (good, expert, and genius), provide an introduction for the novice and continuing interest for the experienced player.

### 3. Wumpus

Chances are if you ever leave your keyboard you have heard of the mythological Wumpus. In the game of Wumpus 1, you are scouring a network of underground caves in search of the prized Wumpus. The dreaded super bats and bottomless pits make Wumpus hunting a risky affair. On each turn, as you wind your way through the caves, you have a choice of moving or shooting through the cave. Bagging a Wumpus wins the game, but if you accidentally stumble into his cave, the Wumpus will enjoy a tasty dinner of sauteed computer freak.

### 4. Wumpus 2

If you master the dodecahedron cave network in Wumpus 1, you may proceed to Wumpus 2 which allows you to choose from five different caves, or you can design your own. Super bats and the infamous bottomless pits are also included in Wumpus 2, so be prepared to jump into the frying pan!

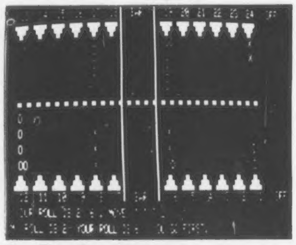


```
COMPY TAKES BOX: 31

WHAT BOX NUMBER DO YOU WANT WALDO? ..
```

### 5. Qubic

Qubic is a three dimensional Tic Tac Toe game. The game is played in a 3 dimensional cube (4x4x4). The object is to outwit the computer and place four pieces in any straight line. Be warned, the computer plays a very tough game and makes no concessions for your ability, or lack of it.



### 6. Backgammon

This is the TRS-80 adaptation of the popular board game. Backgammon uses graphics and all the standard backgammon rules, not a strange computer variation. The computer is your opponent in this version, written by Scott Adams of "Adventure" fame.

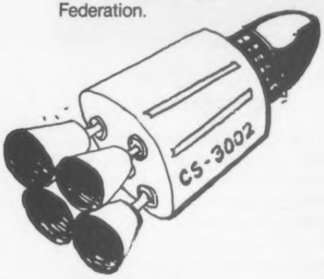
## 5 Adventure Games for the TRS-80!

See page 3

## Space Games-3, CS-3002 (16K)

### 1. Ultra-Trek

Ultra-Trek is a fast-paced version of Star Trek, complete with "real time" action graphics, lasers, Nilon space mines, high energy photon torpedoes, enemy ships that move, and an experimental ray which does something different each time you use it. At the beginning of your mission, you are told the number of Klingon base ships and battle cruisers you must defeat. Klingons have sharp eyes and quick torpedo launchers. They don't wait for you to type in your moves, so you must act quickly to save yourself and the Federation.



### 2. Romulan

Your mission is to destroy an invading Romulan space craft, but you'll have to find it first. The Romulans have a new cloaking device. By activating your sensors, the Romulan's position will be shown briefly, but the sensors use a lot of energy. Maneuver through space and around stars looking for the deadly enemy, but be careful! The nasty Romulans fire back.

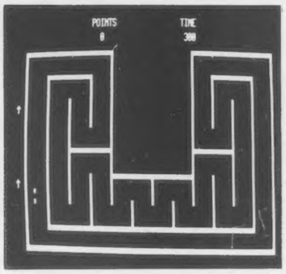
### 3. Star Wars

If you hate Darth Vader, you'll love Star Wars. Take an X-Wing fighter into combat and save the Rebels' base camp. Using the keyboard to control the ship, you must line up the TIE fighters into your sights and zap them with your lasers. This real time game is fun for aliens of all ages. May the Force be with you!

### 4. Star Lanes

Imagine yourself the president of an intergalactic shipping company. In Star Lanes you control sections of the galaxy and, on each turn, are given chances to buy stock in developing businesses. You are free to roam about the galaxy and engage in bartering, business ventures, stock splits, and company takeovers. If you're successful, you may be named Imperial Advisor on Economic Affairs. Entrepreneurs: to your ships.

## Pursuit Games, CS-3004 (16K)



### 1. Stock Car Race

Stock Car Race is a real time racing game on a road race circuit. Your high speed racer is controlled by the "arrow" keys, as you shift up and down through four gears. Take the turns slowly, "floor it" on the straights, but don't blow your engine!

### 2. Maze

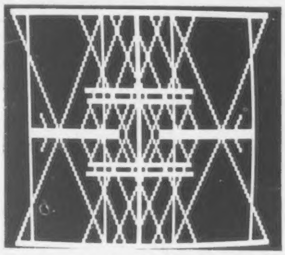
Maze for the Level II 16K machine is a high speed pursuit game. You are timed throughout your run and rated on the basis of elapsed time and the number of moves required to escape. A different maze every time. Nine skill levels.

### 3. Indy Racer

Indy Racer is a real time racing game for the TRS-80. You're in the driver's seat of a red-hot Indy car, changing gears and weaving around the track as you pass your competitors. Indy Racer is similar to the popular arcade-style driving games.

### 4. Depth Charge

As commander of a destroyer, your mission is to destroy as many enemy subs as possible. Move your ship back and forth on the water, positioning yourself over enemy subs as they cruise into range. Depth charges sink slowly, so timing and position are important in this re-creation of the Battle of the Atlantic.

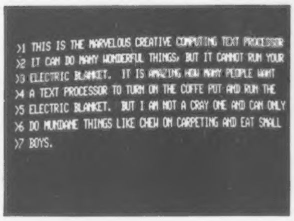


### 5. Kaleidoscope

This graphics demonstration program turns your TRS-80 into a computer age kaleidoscope. You enter the number of lines and size of the display to produce changing patterns on the video monitor. Truly hypnotizing, Kaleidoscope runs continuously to brighten up your home or office.

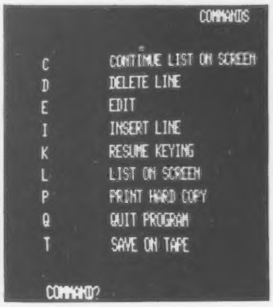
## Text Processing, CS-3302 (16K)

This program turns a 16K, TRS-80 and lineprinter into a line oriented text-processing system.



```
>1 THIS IS THE MARVELOUS CREATIVE COMPUTING TEXT PROCESSOR
>2 IT CAN DO MANY WONDERFUL THINGS, BUT IT CANNOT RUN YOUR
>3 ELECTRIC BLANKET.  IT IS AMAZING HOW MANY PEOPLE WANT
>4 A TEXT PROCESSOR TO TURN ON THE COFFE POT AND RUN THE
>5 ELECTRIC BLANKET.  BUT I AM NOT A CRAY ONE AND CAN ONLY
>6 DO MUNDANE THINGS LIKE CHEW ON CARPETING AND EAT SMALL
>7 BOYS.
```

Developed exclusively for the TRS-80, this program lets you use the computer to enter general text or business letters, edit and modify your work, save text on cassette tapes, and print out a perfect report, document, or letter every time.



```
                              COMMANDS

  C         CONTINUE LIST ON SCREEN
  D         DELETE LINE
  E         EDIT
  I         INSERT LINE
  K         RESUME KEYING
  L         LIST ON SCREEN
  P         PRINT HARD COPY
  Q         QUIT PROGRAM
  T         SAVE ON TAPE


  COMMAND?
```

Editing commands are similar to those used in Level II BASIC, so there are no complicated new commands to learn. Lines may be either inserted or deleted. A special format is available to speed entry of business letters. Final printout can be done in numbered pages and you may print multiple copies.

## TRS-80 Software on Disks, (32K)

Now, Creative Computing offers its cassette software on floppy disks. These are not just the same programs simply stored on a disk, but enhanced, menu driven libraries for the ultimate in ease of use. Machine language routines have been relocated to be compatible with disk basic, and the file handling, such as is used in the Checking Account program, can now be handled using your TRS-80 mini-floppy system. Make the most of your TRS-80 with Creative Computing floppy disk software.

**CS-3501 ECOLOGY SIMULATIONS-1**
Pop
Sterl
Tag
Buffalo

**CS-3502 ECOLOGY SIMULATIONS-2**
Pollute
Rats
Malaria
Diet

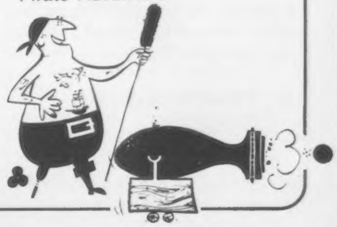
**CS-3507 SOCIAL & ECONOMIC SIMULATIONS**
Limits
Market
USPop

**CS-3503 GAMES PACK-1**
Backgammon
Qubic
Flip Disc
Wumpus 1
Wumpus 2
Mugwump
Ultra Trek
Romulan
Star Wars
Star Lanes
Stock Car Race
Maze
Indy Racer
Depth Charge
Kaleidoscope
Tunnel Vision
Evasion
Jigsaw
The Masters
Motor Racing

**CS-3504 TEXT PROCESSING CHECKING ACCOUNT**

**CS-3505 ADVANCED STATISTICS**
Data File Manager
Descriptive Statistics
Two Variable Statistics
Crosstabulation
Regression
Multiple Linear Regression
Correlation Analysis
Analysis of Variance
Advanced Multiple Regression

**CS-3506 ADVENTURE 1 AND 2**
Adventure
Pirate Adventure



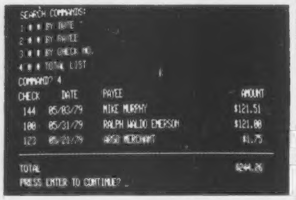
TRS-80
LEVEL II

## Investment Analysis, CS-3305 (4K)

This program was originally developed for personal use by an investment specialist. Creative Computing Software now makes this package available for you to analyze your investments and investment decisions. Programs in this package include regression analysis, stock market simulations, market/stock values, risk analysis, time related investments, and tax analysis. (Available in October)

## Checking Account, CS-3304 (16K)

This program does not replace the standard method of checkbook balancing. Instead it acts as an aid in keeping track of individual and monthly expenses. You enter the amounts and payees of individual checks, and save the information on cassette tape. The program then allows you to analyze your checks by payee or date of payment. Keep track of where your money is going and how effective your budget is.



```
SEARCH COMMANDS:
1 ■ ■ BY DATE
2 ■ ■ BY PAYEE
3 ■ ■ BY CHECK NO.
4 ■ ■ TOTAL LIST
COMMAND? 4
CHECK    DATE      PAYEE                    AMOUNT
 144   05/03/79   MIKE MURPHY              $121.51
 100   05/31/79   RALPH WALDO EMERSON      $121.00
 123   05/21/79   ARGO MERCHANT              $1.75

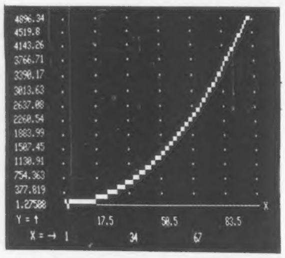
TOTAL                                      $244.26
PRESS ENTER TO CONTINUE? _
```

## Graphic Package, CS-3301 (16K)

This package provides a variety of interesting and useful graphing routines. Graphing Package combines text and TRS-80 graphics to plot a variety of functions and other graphs.

### 1. Bar Graph

Bar Graph plots graphs for up to six different categories. An optional display does conversion to a line graph.

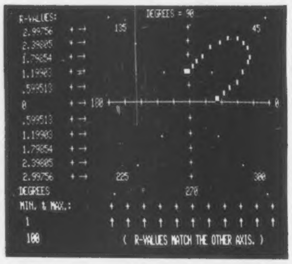


### 2. Cartesian Coordinate Graphing

This program plots a standard X, Y graph from a user entered function. A special feature of this program automatically scales of the Y-axis.

### 3. Polar Coordinate Graphing

Rarely found in computer graphing packages, this polar graphing program provides plots of polar functions. The program labels all axes, features automatic scaling, and lets you input the range and increment of the plot. A unique and valuable program.



### 4. Parametric Graphing

Parametric functions are functions in which both x and y are expressed in terms of an independent variable t. The resulting graph is X vs. Y. This program allows the user to input two parametric functions and produces a graph.

### 5. Linear and Parabolic Regression

These two programs are used for data analysis which can later be entered into the graphing routines. Regression routines analyze how well a series of points fit on a linear or quadratic function.

## Tape Manager and Advanced Statistics, CS-3303 (16K)

This package may be the ultimate in statistical applications for the 16K TRS-80. Attractively packaged in a vinyl binder with a large instruction booklet, Advanced Statistics will provide you with the ability to perform statistical tests never before available on small computers. Its cassette based data file system allows you to store, retrieve, and transform data files for use in several different tests.

### 1. Tape Manager

Tape Manager, the heart of the statistical file management, allows you to create, edit, and transform data files. Unique to this program are features that allow the user to perform transformations on variables, extract and create subfiles, and selectively copy records. Up to twenty variables and an unlimited number of cases can be processed.

### 2. Descriptive Statistics

Descriptive Statistics computes the mean, standard deviation, standard error of estimate, variance, skewness, kurtosis, range, median, and quartiles for a variable and constructs a histogram for each value. A test scoring option for conversion of raw scores into percentiles is included.

### 3. Two Variable Statistics

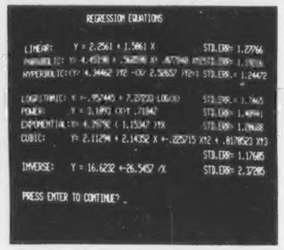
This program calculates descriptive statistics for each variable. It performs a t-test for the difference of means, computing the product-moment correlation coefficient and its associated significance level. In addition, it performs linear regression and computes standard error of estimate for Y.

### 4. Crosstabulation

This program constructs contingency tables for displaying frequencies, column percentages and table-wide percentages for each cell. It computes the Chi-square, the level of significance and gamma statistics. Tables as large as 10x10 may be evaluated.

### 5. Regression-Trend Analysis

This program computes least-squares regression coefficients from time-series or paired data for best-fit equations (linear, parabolic, hyperbolic, logarithmic, power, exponential and cubic types). Calculates standard error of estimate for each equation and more.



```
                   REGRESSION EQUATIONS

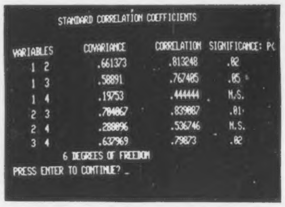
LINEAR:     Y = 2.2561 + 1.5861 X              STD.ERR= 1.27766
PARABOLIC: Y= 4.45198 + .568598 X+ .077848 X↑2STD.ERR= 1.19816
HYPERBOLIC:(Y/ 4.34462 )↑2 -(X/ 2.52657 )↑2=1 STD.ERR.= 1.24472

LOGRITHMIC: Y =-.957445 + 7.27230 LOG(X)      STD.ERR.= 1.[illegible]
POWER:      Y = 3.1093 (X)↑ .71842            STD.ERR= 1.[illegible]
EXPONENTIAL:Y= 4.39792 ( 1.15347 )↑X          STD.ERR= 1.[illegible]
CUBIC:      Y= 2.11294 + 2.14352 X +-.225715 X↑2 + .0170523 X↑3
                                               STD.ERR= 1.17685
INVERSE:    Y = 16.6232 +-26.5457 /X           STD.ERR= 2.37285

PRESS ENTER TO CONTINUE? _
```

### 6. Multiple Linear Regression

Performs multiple linear regression using up to ten independent variables. The program computes both unstandardized and normalized coefficients, covariance, multiple correlation coefficient, and the standard error of estimate.



```
        STANDARD CORRELATION COEFFICIENTS

VARIABLES    COVARIANCE    CORRELATION  SIGNIFICANCE: P<
   1  2        .661373       .813248       .02
   1  3        .58891        .767405       .05
   1  4        .19753        .444444       N.S.
   2  3        .704067       .839087       .01
   2  4        .288096       .536746       N.S.
   3  4        .637969       .79873        .02
        6 DEGREES OF FREEDOM
PRESS ENTER TO CONTINUE? _
```

### 7. Correlation Analysis

Computes product-moment correlation matrices, multiple correlation coefficients and partial correlation coefficients with their associated significance levels.

### 8. Analysis of Variance

This program performs one-way and two-way analysis of variance for a maximum of ten groups in each control variable. Statistics include the mean and standard deviation for each group, sum of the squares, degrees of freedom, mean square, F-ratios, and significance level.

## Economic and Ecology Simulations

The Ecology Simulations series are a unique educational tool. They are based on "simulation models" developed by the Huntington Two Computer Project at the State University of New York at Stony Brook under the direction of Dr. Ludwig Braun. The programs and accompanying documentation are written for self-teaching or classroom use and include background material, sample exercises and study guides. Graphic displays were specially developed by Jo Ann Comito at SUNY and Ann Corrigan at Creative Computing. The Ecology Simulations packages are a remarkable educational application of micro-computers.

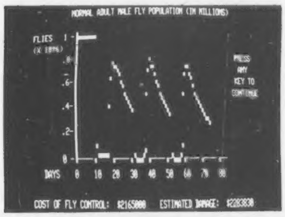
## Ecology Simulations-1, CS-3201 (16K)

### 1. Pop

The POP series of models examines three different methods of population projection, including exponential, S-shaped or logistical, and logistical with low density effects. At the same time the programs introduce the concept of successive refinement of a model, since each POP model adds more details than the previous one.

### 2. Sterl

STERL allows you to investigate the effectiveness of two different methods of pest control—the use of pesticides and the release of sterile males into the fly population. The concept of a more environmentally sound approach versus traditional chemical methods is introduced. In addition, STERL demonstrates the effectiveness of an integrated approach over either alternative by itself.


NORMAL ADULT MALE FLY POPULATION (IN MILLIONS)
FLIES
(X 10↑6)
1
.8
.6
.4
.2
0
DAYS 0 10 20 30 40 50 60 70 80
PRESS ANY KEY TO CONTINUE
COST OF FLY CONTROL: $2165000 ESTIMATED DAMAGE: $2283830

### 3. Tag

TAG simulates the tagging and recovery method that is used by scientists to estimate animal populations. You attempt to estimate the bass population in a warm-water, bass-bluegill farm pond. Tagged fish are released in the pond and samples are recovered at timed intervals. By presenting a detailed simulation of real sampling by "tagging and recovery," TAG helps you to understand this process.

### 4. Buffalo

BUFFALO simulates the yearly cycle of buffalo population growth and decline, and allows you to investigate the effects of different herd management policies. Simulations such as BUFFALO allow you to explore "What if" questions and experiment with approaches that might be disastrous in real life.

## IQ Test, CS-3203 (16K)

IQ tests have been the subject of a great deal of controversy in the past few years. Yet, few of us know our IQ score. Now you can find out with our IQ test.

Taking advantage of the TRS-80's graphic capabilities, this test consists of 60 multiple choice questions. A special machine language routine does the scoring of the test and makes cheating almost impossible.

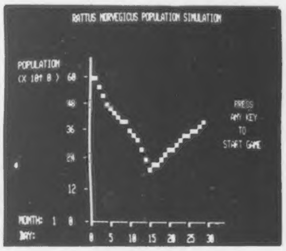
## Ecology Simulations-2, CS-3202 (16K)

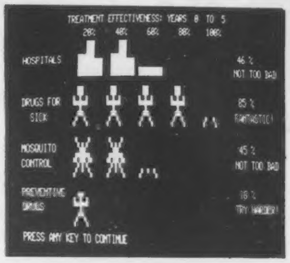
### 1. Pollute

POLLUTE focuses on one part of the water pollution problem; the accumulation of certain waste materials in waterways and their effect on dissolved oxygen levels in the water. You can use the computer to investigate the effects of different variables such as the body of water, temperature, and the rate of dumping waste material. Various types of primary and secondary waste treatment, as well as the impact of scientific and economic decisions can be examined.

### 2. Rats

In RATS, you play the role of a Health Department official devising an effective, practical plant to control rats. The plan may combine the use of sanitation and slow kill and quick kill poisons to eliminate a rat population. It is also possible to change the initial population size, growth rate, and whether the simulation will take place in an apartment building or an entire city.


RATTUS NORVEGICUS POPULATION SIMULATION
POPULATION
(X 10↑ 0)
60
48
36
24
12
0
MONTH: 1
DAY:
0 5 10 15 20 25 30
PRESS ANY KEY TO START GAME



### 3. Malaria

With MALARIA, you are a Health Official trying to control a malaria epidemic while taking into account financial considerations in setting up a program. The budgeted use of field hospitals, drugs for the ill, three types of pesticides, and preventative medication, must be properly combined for an effective control program.

### 4. Diet

DIET is designed to explore the effect of four basic substances, protein, lipids, calories and carbohydrates, on your diet. You enter a list of the types and amounts of food eaten in a typical day, as well as your age, weight, sex, health and a physical activity factor. DIET is particularly valuable in indicating how a diet can be changed to raise or lower body weights and provide proper nutrition.

## Social and Economic Simulations
## CS-3204 (16K)

### 1. Limits

LIMITS is a micro-computer version of the well known "Limits to Growth" project done at MIT. It contains a model of the world that is built of five subsystems (population, pollution, food supply, industrial output, and resource usage) linked together by six variables: birth rate, death rate, pollution generation, resource usage rate, industrial output growth rate, and food production rate.

### 2. Market

Market allows two or more people to play the roles of companies who are competing for the market for a particular product: in this case, bicycles.

Each player makes marketing decisions quarterly including the production level, the advertising budget, and the unit price of the product for his/her company.

### 3. USPop

USPOP allows the user to study many aspects of the United States' human demography (population change) including population growth, age and sex distribution. USPOP makes population projections and investigates the consequences of many different demographic changes. (Available in November).

## TRS-80 LEVEL I

## Games-1, CS-2001 (4K)

### 1. Battling Deathstars

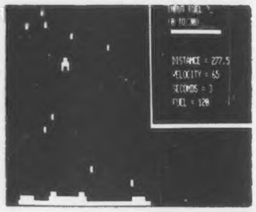
Battling Deathstars is an action-packed, two player game which operates in real time. You control a powerful and deadly Deathstar travelling in hyperdrive on a special mission to destroy your opponent. Using keyboard controls, you rotate and move your Deathstar in all directions, and fire from your gunport. The closest thing yet to a galactic dogfight!

### 2. Hangman

Hangman for the Level I TRS-80 is an adaptation of the classic word game. Use the built-in word list or enter your own stumpers. This game with its entertaining graphics provides an amusing and educational passtime for children of all ages.

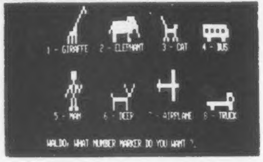
### 3. Lunar Lander

Lunar Lander is a Level I version of the classic moon landing computer game with full graphics. You control the amount of thrust of the retro rockets as the capsule descends. Try to touch down under 5 ft/sec, or you may create a new lunar crater!



### 4. Math Race

Math Race uses graphics to involve the user in arithmetic problems. Players enter their names, choice of board marker and decision to play against the computer or a friend. Players' ages and skill levels determine the difficulty of the problems. A helpful tool for learning arithmetic.



```
WALDO, WHAT NUMBER MARKER DO YOU WANT ?
```

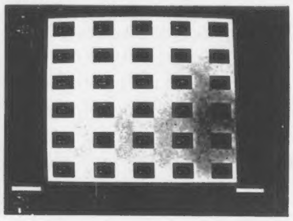
### 5. Checkers

Checkers for the TRS-80 is a two-program package consisting of an instruction program and checkers program. Playing on a beginner's level, the computer uses straightforward strategy to make its moves. Checkers is ideal for introducing the game to children.

## Games-2, CS-2002 (4K)

### 1. Remember Where

Remember Where is a one or two player game similar to the card game (and television game) of Concentration, in which memory and daring are the keys to success. This game uses a graphic board and allows you to match memory and skill with the computer or another person. Ready, set, Remember Where!



### 2. Biogram

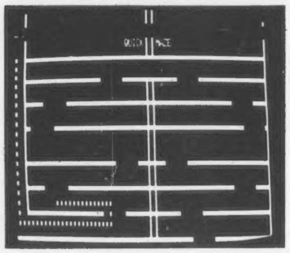
Feeling lethargic and depressed, or are you on a dangerous "critical day"? Whether or not you're a true believer in biorythms you'll find it interesting to watch Biogram generate graphic representations of your physical, emotional and mental states for each day of the month. Biogram also has extended forecast features and special highlighting of "critical days".

### 3. Yahtzee

Yahtzee is our version of the popular dice and strategy game for the TRS-80. You and a friend compete for the highest score.

### 4. Maestro

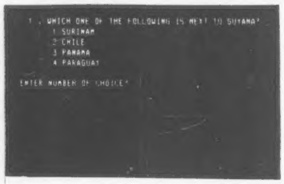
Have you ever wanted to compose music? This 4K Level I program comes complete with a pre-programmed tape of Yankee Doodle Dandy and all the software needed to compose your own tunes. An excellent introduction to computer synthesized music at a fraction of the normal cost. Maestro requires no hardware modifications to your computer and plays music through an ordinary AM radio.



### 5. Quick Maze

In Quick Maze, you guide an automated robot through a computer-designed maze. Depending on your skill and coordination, it can clear the maze or crash head on into a wall. This real time game offers a choice of eight different speed for fast, frantic fun!

## Geography, CS-2201 (4K)



```
1 . WHICH ONE OF THE FOLLOWING IS NEXT TO GUYANA?
     1 SURINAM
     2 CHILE
     3 PANAMA
     4 PARAGUAY
ENTER NUMBER OF CHOICE?
```

The Creative Computing Geography series covers all regions of the United States, Europe, Central and South America, and Africa. Each drill contains several multiple choice questions about world geography (states, countries and bodies of water). All data used in these programs have been selected from a 1976 World Atlas and all are current (including the African nations). Unique program design ensures different questions throughout each run. Geography is an excellent instructional tool for personal and educational applications.

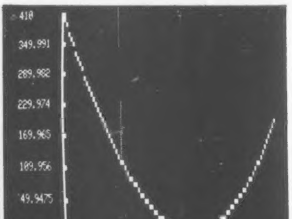
## Tape Manager/Graphics/Statistics, CS-2301 (4K)

### 1. Tape Manager

Tape manager is a cassette tape data management system for the 4K Level I TRS-80. This program allows you to use long cassette tapes (C-60s) to store up to 8 programs. Each program can be later located automatically by the Tape Manager program.

### 2. Function Graph

Function Graph helps you graph equations of the form y=f(x). Functions of any type (exponentials, parabolas, ellipses, etc.) may be represented graphically using this program. Function Graph allows you to enter both x and y limits, or will scale the y-axis automatically.



### 3. Statistics

The following five programs provide the Level I owner with statistical computations. All will load and run in 4K of memory.

ELEMENTARY STATISTICS computes the mean, variance, and standard deviation for a population or a sample.

LINEAR CORRELATION allows you to determine the strength of the linear relationship between two variables. The primary statistic provided is the linear correlation coefficient. In addition, the program computes the means and variances of the variables.

t-TEST determines whether the differences between the means of two groups are statistically significant. You may choose either matched pairs or standard design.

ANALYSIS OF VARIANCE performs an analysis of variance on 3 to 6 groups to determine whether the variances of the groups are significantly different.

ANALYSIS OF COVARIANCE is useful for same subject designs. The primary statistic computed is the F-value.

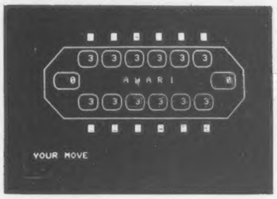
## Investment Analysis, CS-3305 (4K)

Programs in this package include regression analysis, stock market simulations, market/stock values, risk analysis, time related investments, and tax analysis. (Available in October).

PET

## Logic Games-1, CS-1001 (8K)

How logical are you? Test your strategy and logical abilities against the computer or another player in these fun and challenging games.



YOUR MOVE

### 1. Awari

Awari is an ancient African game played with beans on a board divided into pits: six per player on the sides and two home pits at each end of the board. Test your strategy against PET's by moving more beans into your home pit. On each move, you take the beans from any pit on your side and "sow" them, one in each pit going counterclockwise. Additional rules make the game more interesting. The program has a learning mechanism which makes it progressively harder to beat. Uses graphics.

### 2. Bagels

Bagels anyone? Try to guess the computer's secret three-digit number. The computer will respond to your guess with the clues pico, fermi, or bagels, to indicate which digits are correct and which are in the right place.

### 3. Chomp

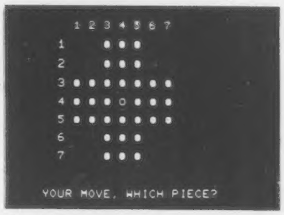
Hungry? Well, have a cookie, but don't bite the poisoned corner! Two or more players take turns chomping on a cookie (actually a grid up to 9x9). The loser is the player forced to chomp the poisoned corner. A challenging game of strategy.

### 4. Flip-Flop

The object of Flip-Flop is change a row of ten X's to a row of 0's in a minimum number of moves. On each move you may flip any of the ten positions, but the catch is that flipping one letter may cause several others to flip too.

### 5. Hexpawn

Hexpawn is played with chess pawns on a 3x3 board. The pawns are moved as in chess. The object of the game is to get one of your pawns to the opposite side of the board or to prevent your opponent from moving. Hexpawn is a learning game-the computer begins with random moves and learns how to play, gradually becoming an excellent player.



YOUR MOVE, WHICH PIECE?

### 6. Hi-Q

In this version of the Old European solitare game of logic with jumping pegs. You try to leave one peg in the center hole. A tough challenge.

---

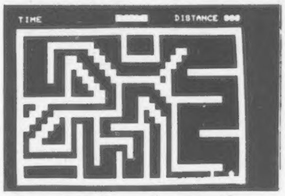
## Action Games, CS-1008 (8K)

### 1. Splat

This game simulates a parachute jump. The object is to open your chute at the last possible moment without going SPLAT! You can jump on any planet, even the sun, or set your own terminal velocity, acceleration, and freefall time. After setting the timer, the PET displays the descent of the parachutist. "...they picked him up and poured him from his boots."

### 2. Car Race

Come to the PET 500! Drive a car around the racetrack at your own speed, and see if you qualify for the Grand Prix!



### 3. Breakout

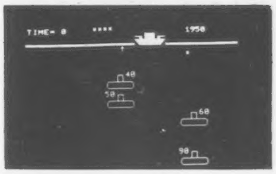
Here's a dynamic version of Breakout for your PET. Try to knock all the bricks off the wall for a maximum number of points. The position of the paddle is controlled by the keyboard.

### 4. Bowling

Welcome to the PET Bowling Lanes! Up to 4 players can compete for the highest score. You can throw hooks as well as straight balls in this game. But stay out of the gutter!

### 5. Tank

A thrilling action game that everyone will enjoy! Every game has a new layout with walls, trees, and lakes. Maneuver your tank around the obstacles and try to blow up your opponent's tank. Tank has screen wrap around and ricocheting projectiles. This action game is one of the staff's favorites.



### 6. Subs

You are in control of a ship and drop depth charges to sink the subs and score points, while the subs launch missiles at you. Subs carry different point values depending on their depth. Extensive game options allow you to set many parameters—speed, frequency of enemy missiles, etc. Subs is another of the staff's favorites.

---

## Sensational Simulations, CS-1201 (8K)

### 1. Animal

In this game, you teach the computer. You think of an animal and the computer tries to guess what it is. If the computer guesses incorrectly it will ask for a yes-no question that differentiates the animal you were thinking of from the one it guessed. In this way the computer 'learns' new animals. And just what does distinguish a leopard from an ocelot?

### 2. Fur Trader

You are the leader of a French fur trading expedition in 1776 leaving the Ontario area to sell furs and get supplies for the next year. You can choose the fort at which you wish to trade and the type of furs you wish to trade. To get the best prices for your furs, you must take your chances with the Iroquois Indians, the Lachine Rapids, and other hazards.

### 3. Hammurabi

Test your administrative abilities by governing ancient Sumeria for a 10-year term in office (if you last that long). Each year you must make decisions of how much to feed your people, and what land to cultivate and trade with neighboring city-states. Hazards include a bad harvest and rats that eat the grain in storage.

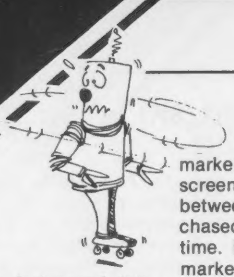
### 4. Stock Market

Try your luck in the stock market and make your fortune! You start with $10,000 and may buy or sell stocks with a 1% brokerage fee on each transaction. The computer controls the mini-economy and the stock exchange.

### 5. Word

How rich is your vocabulary? Match your wits against the computer by trying to guess the computer's mystery word. After each guess, clues are provided which indicate how many of the letters in your guess are in the mystery word and if any are in the correct position.

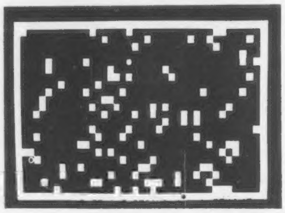
PET

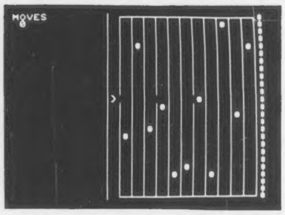


## Graphics Games-1, CS-1004 (8K)

### 1. Chase

Chase is a fast-paced two-player game. One player pursues the other through a maze of obstacles and "zap doors" which instantly transport the marker to another place on the screen. The players alternate between chasing and being chased, and play for the best time. Each player controls his marker with a set of nine directional keys.





### 2. Escape

Try to escape from a maximum-security prison patrolled by robot guards who destroy anyone they encounter. You must time your forward and backward movements precisely to move through the doors which open and close periodically, while at the same time avoiding the guards. The robot guards can tell when you're nearby and take action to intercept you.

### 3. Dart

Here's a game in which you must estimate the answer to an arithmetic problem as quickly as possible. Choose the type of problem and the skill level. The accuracy of your estimates are shown graphically on a dartboard. For one or two players.

### 4. Snoopy

Curse you Red Baron! Try to shoot down the Red Baron before he gets you by correctly computing positive and negative distances on a number line. There are five timed skill levels ranging from Cadet to Ace. Which one are you?

### 5. Sweep

Hit nine targets in the correct order by controlling the path of a rollerball which increases in speed. Be careful—if you go too near a wrong target you will be deflected away and lose points.

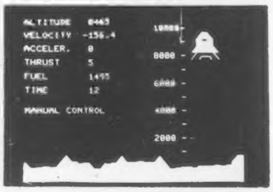
---

## Graphics Games-2, CS-1005 (8K)

This exciting set of games lets you wipe out your opponent with radioactive material or a cannon, land on the moon, or test your strategy against the PET.

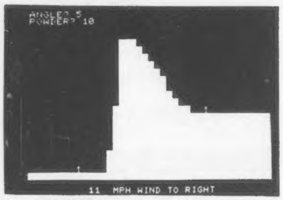
### 1. LEM

In this graphic real time lunar landing game, you must land on the moon's surface with the lowest possible velocity. You can control the thrust of your retro-rockets with the number keys but have only a limited amount of fuel. The automatic pilot option can be activated and deactivated with the keyboard. You take a walk on the moon and plant a flag if you land successfully.



### 2. Nuclear

Nuclear is an exciting strategy game for two players. Each player, in turn, places a particle of radioactive material on a 6x6 board. When the number of particles at a location reaches its critical mass, it explodes sending particles to adjacent squares. As the board fills up, a single explosion can cause long chain reactions. The object of the game is to cause the right chain reaction to wipe out all of your opponent's pieces. Nuclear is a game of skill, fast decisions, and quick reversals, providing fun for many hours.



### 3. Artillery

In the game of Artillery, two players shoot cannons at each other over computer-generated terrain. You choose the firing angle and the number of bags of powder to be used, and then observe the trajectory of the shot on the screen. Artillery makes good use of PET's graphics, changing the terrain and wind speed for each game.

### 4. Bounce

Bounce is an intriguing graphics demonstration which traces the path of a ball as it bounces around the screen.

### 5. Checkers

PET matches strategy against you in this popular game. The computer does not look ahead more than one move ahead, hence the game is best suited for beginning players.

### 6. Dodgem

Dodgem is played on a checker type board against the computer or another player. The object of the game is to block your opponent to slow him down. One player moves pieces from the bottom of the board to the top, and the other player moves from left to right trying to get all the pieces off the board. This is a challenging strategy game.

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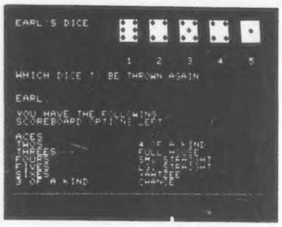
## Board Games, CS-1007 (8K)



```
EARL'S DICE

                1   2   3   4   5
WHICH DICE TO BE THROWN AGAIN

EARL.

YOU HAVE THE FOLLOWING
SCOREBOARD OPTIONS LEFT

ACES
TWOS                 4 OF A KIND
THREES               FULL HOUSE
FOURS                SM. STRAIGHT
FIVES                LG. STRAIGHT
SIXES                YAHTZEE
3 OF A KIND          CHANCE
```

### 1. Yahtzee

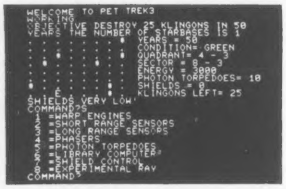
In this is PET version of the popular dice game of Yahtzee, the PET rolls the dice, gives you your options and keeps score for up to four players.

### 2. Blackjack

Come to the PET Casino! Up to four players can try their playing skill and luck against the PET dealer in this game of Blackjack.

### 3. Backgammon

Test your backgammon strategy against the PET's. The computer varies its strategy both within and between games and plays an excellent game! It even doubles if it is winning. This version of Backgammon makes impressive use of PET graphics.



```
WELCOME TO PET TREK3
WORKING
OBJECTIVE DESTROY 25 KLINGONS IN 50
YEARS THE NUMBER OF STARBASES IS 1
 .  .  .  .  .  .  .  *  YEARS = 50
 .  .  .  .  .  .  .  .  CONDITION= GREEN
 .  .  *  .  .  .  .  *  QUADRANT= 4 - 3
 .  *  .  .  .  *  .  .  SECTOR = 8 - 3
 .  .  .  .  .  .  .  .  ENERGY = 3000
 .  .  .  .  .  .  .  .  PHOTON TORPEDOES= 10
 *  .  .  .  .  .  *  .  SHIELDS = 0
 .  .  E  .  .  .  *  .  KLINGONS LEFT= 25
SHIELDS VERY LOW!
COMMAND?S
 1 =WARP ENGINES
 2 =SHORT RANGE SENSORS
 3 =LONG RANGE SENSORS
 4 =PHASERS
 5 =PHOTON TORPEDOES
 6 =LIBRARY COMPUTER
 7 =SHIELD CONTROL
 8 =EXPERIMENTAL RAY
COMMAND?
```

### 4. Trek3

Trek3 is our PET version of the popular Startrek game. You, as captain of the Enterprise, must destroy the Klingons who threaten the Federation. This real time version gives you control over phasers, torpedoes, warp drive, and a "computer" function to help out in tight situations. This is a real classic that should be in everyone's software library.

### 5. One Check

One Check is an intriguing game of strategy. You start with two rows of checkers on the outside spaces of all four sides of the board. The object of the game is to remove as many checkers as possible by diagonal jumps. Almost chess-like in nature, moves must be planned well ahead so you do not leave isolated pieces. It is very challenging (almost impossible!) to clean off the board, but it can be done!

## Number Games-2, CS-1002 (8K)

The Number Games tape contains an exciting family of "guess the number" games. Pit your skill against the PET in these six games.

### 1. Guess

Guess is the simplest of the number guessing games. The computer selects a number between 1 and any limit you set. You then guess the number using the clues "too high" or "too low" provided by the computer.

### 2. Letter

Letter is an alphabetic version of the game of Guess. It's not as simple as it sounds.

### 3. Number

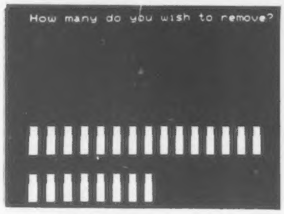
This game is different in that you only get one guess per round. The computer-selected number is between 1 and 5, and you gain or lose points depending on how close your guess is. If you guess the number exactly, you hit the jackpot and double your point count.

### 4. Trap

The computer selects a random number between 1 and 100, and you must guess the number by trapping it between your two numbers. The computer tells you if the mystery number is higher, lower, or between your trap numbers.

### 5. Stars

You try to guess a mystery number between 1 and 100. But this time the computer tells you if you're getting closer or farther away, but not the direction to go. It requires a different playing strategy.



```
How many do you wish to remove?
```

### 6. 23-Matches

You start with 23 matches. You and the computer alternate taking matches away from the pile. On each turn you may take 1, 2, or 3 matches. The player forced to take the last match loses. Uses graphics.

## Conversational Games-1, CS-1006 (8K)

### 1. Eliza

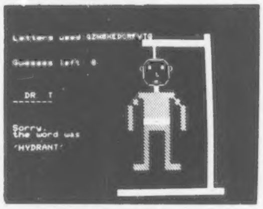
Eliza is the PET version of the famous conversational program written by Dr. Joseph Weizenbaum. In it, the computer plays the role of a psychoanalyst, responding to your statements. Eliza works by analyzing your input, searching for certain key words and phrases, and preparing the appropriate reply. Amaze your non-computer friends with intelligent babbling!

### 2. Hurkle

In five moves or less, you try to find the Hurkle who is hiding on a 10x10 grid. He gives you clues like "Go Northwest" or "Go South". This game is useful for teaching children how to use Cartesian plane coordinates, or just to play for fun.

### 3. Hangman

Hangman is the PET version of the popular word game. The secret word may be selected by a friend or the computer. The graphics makes the game fun as well as educational. Try these words with your Scrabble champion: vizsla, snitch, mnemonic, or frankly.



```
Letters used:[illegible]

Guesses left: 0

 DR  T
-------

Sorry,
the word was
'HYDRANT'
```

### 4. Hexletter

Hexletter is an intriguing strategy game played on a hexagonally-shaped board. The object is to capture more letters than your opponent, which can be the computer or a friend.

### 5. Haiku

You and the PET compose Haiku poetry. The computer has a library of stored phrases and puts them together in sometimes funny, sometimes meaningful ways.

Adventure!
Two Adventure games are available for the PET
See page 3

## Logic Games-2, CS-1003 (8K)

Here are six fascinating and challenging games of logic to test your skill and strategy.

### 1. Rotate

A 4x4 board is filled with the letters A through P in random locations. Your task is to put them in alphabetical order in as few moves as possible by rotating groups of four letters counterclockwise. Sound easy? Try it!

### 2. Strike-9

In Strike-9, you begin with a list of numbers 1 through 9. On each roll of the dice, you must remove digits from the list adding up to the roll. The game ends if you can't do it. The object is to remove all nine numbers.

### 3. Nim

Nim is one of the oldest two-person games known to man. Here you play against the PET. You can specify the number of piles of beans, the size of each pile, and the win option of either taking or not taking the last bean. Uses graphics.

### 4. Even-Wins

Challenge the computer! A random odd number of beans are placed in a resource pile. On each turn players take from 1 to 4 beans from the pile. When there are no more beans in the resource pile, the player with the even number of beans wins. The computer does not like to lose.

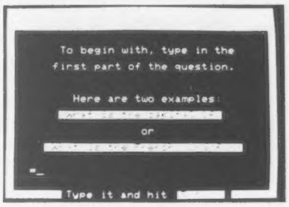
### 5. Not One

The game of Not One is played with two players (you and a friend or the computer) and a pair of dice. Players roll the dice and get points for the number rolled. You can continue rolling as long as you wish, but if any roll is the same as your first, your score for that round is 0. Win by having the highest score at the end of ten rounds.

### 6. Batnum

Batnum (Battle of Numbers) is a completely generalized game involving taking beans from a pile. You determine the size of the resource pile, the minimum and maximum beans per turn, the win option, and who goes first. Uses graphics.

## Study Made Easy, CS-1202 (8K)



```
To begin with, type in the
first part of the question.

Here are two examples:

or

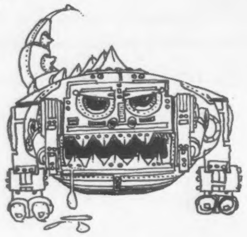
Type it and hit
```

Study Made Easy is a quick and easy way to study. You decide which subjects you wish to study. You decided how fast you want to work and when you've done enough. The PET becomes your assistant, aiding in the entry of questions and answers.

Study Made Easy will create study drill tapes automatically. You can use this program to study chemical symbols, U.S. presidents, or any other subject which can be studied by drill and practice. The computer creates a tape that you can place in the PET and use immediately. You don't need to know anything about computers to use Study Made Easy.

Study Made Easy comes with three prepared drills and the program needed to make new study drills packaged in an attractive cassette binder. The programs are interactive, self-instructing and easy to use.

## Strategy Games, CS-8004 (32K)



### 1. Wumpus 1

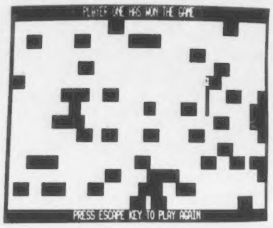
Chances are if you ever leave your keyboard you have heard of the mythological Wumpus. In the game of Wumpus 1, you are scouring a network of underground caves in search of the prized Wumpus. The dreaded super bats and bottomless pits make Wumpus hunting a risky affair. On each turn, as you wind your way through the caves, you have a choice of moving or shooting through the cave. Bagging a Wumpus wins the game, but if you accidentally stumble into his cave, the Wumpus will enjoy a tasty dinner of sauteed computer freak.

### 2. Wumpus II

If you master the dodecahedron cave network in Wumpus I, you may proceed to Wumpus II which allows you to choose from five different caves, or you can design your own. Super bats and the infamous bottomless pits are also included in Wumpus II, so be prepared to jump into the frying pan!

### 3. Trap (Machine Language)

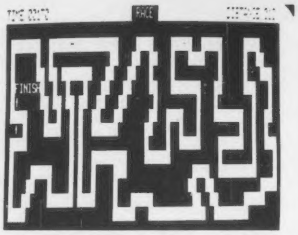
This two-player game challenges you to circle and trap your opponent. Move your marker around the board, leaving a trailing path that cannot be crossed. This real-time game gets very frantic as the markers move faster and faster.



### 4. Race

(Cassette Extended BASIC)

RACE is a car racing game which gives you a choice of three different tracks. Use the number pad to control the direction of your Formula 1 racer around the course to get the best time while avoiding crashes.



### 5. Kingdom

(Cassette Extended BASIC)

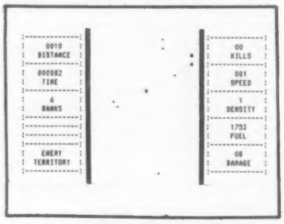
This is a particularly challenging version of the popular Hammurabi game. You rule a kingdom, sowing and reaping crops, buying and selling land and trying to keep the peasants happy. Hazards include bad weather and rats in the grain bin. Remember too, how popular impeachment was in the old days, especially when the natives got restless. (Available in October)

## Space Games-4, CS-8003 (32K)

### 1. Asteroid

(Machine language)

How good an astrogator are you? ASTEROID gives you a chance to find out as you navigate through space, avoiding asteroids, stars and the hostile space meanies. You have torpedoes with which to defend yourself, but the enemy shoots back with deadly accuracy. This real-time program will run in 16K.



### 2. Lunar

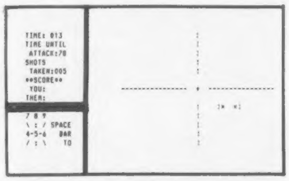
(Cassette Extended BASIC)

This traditional and popular lunar landing game puts you in the pilot's seat of an Apollo space mission. Control the speed of descent and horizontal motion of the spacecraft. This version also adds lunar mountains for an extra challenge.

### 3. Star Wars

(Cassette Extended BASIC)

If you hate Darth Vader, you'll love Star Wars. Take an X-Wing fighter into combat and save the Rebels' base camp. Using the number pad to control the ship, you must line up the TIE fighters in your sights and zap them with lasers. This real time game is fun for aliens of all ages. May the Force by with you!

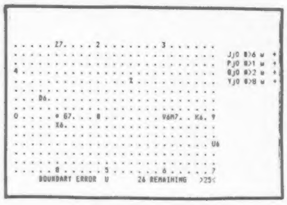


### 4. Romulan

(Cassette Extended BASIC)

Your mission is to destroy an invading Romulan space craft, but you'll have to find it first. The Romulans have a NEW cloaking device. By activating your sensors, the Romulan's position will be shown briefly, but the sensors use a lot of energy. Maneuver through space and around stars looking for the deadly enemy, but be careful! The nasty Romulans fire back. (Available in October)

## Air Traffic Controller, CS-8001 (16K)



This real time machine language program puts you in the chair of an air traffic controller. There are 27 airplanes - jets and prop planes - which must be controlled as they land, take off, and fly over your air space. You give the orders to change altitude, turn, maintain a holding pattern, clear for approach, and land at your two airports. This realistic simulation includes navigational beacons, collisions, and requires the planes to take off and land into the wind. Air Traffic Controller was written by an air traffic controller and is a popular favorite of the Creative Computing staff! (Available in October)

## Reading Comprehension, CS-8201 (20K)

Reading comprehension is an important skill for any student to master. Unfortunately, most traditional methods for developing this skill have been tedious for both the student and instructor. Reading Comprehension is a five cassette package designed to help develop these skills.

Teachers have complete control over the subject matter and level of difficulty of the exercises. The package uses cassette based files to present a short story and accompanying multiple choice questions on the screen. Two of the programs are used for creating, copying, and editing these files. Two other programs use these files to present the story and the quiz. The final program contains a sample short story and questions. A 32-page instruction manual is included in the package.

The package requires a SOL-20 with a minimum of 32K of memory and Processor Technology's Extended Cassette BASIC.

**CP/M**

## 8" DISKS

### Basic Games-1, CS-9001

Includes the Following:

Acey Ducey
Amazing
Animal
Awari
Bagels
Banner
Basketball
Batnum
Battle
Blackjack
Bombardment
Bombs Away
Bounce
Bowling
Boxing
Bug
Bullfight
Bullseye
Bunny
Buzzword
Calendar
Change
Checkers
Chemist
Chief
Chomp
Civilwar
Combat
Craps
Cube
Depth Charge
Diamond
Dice
Digits
Even Wins I
Even Wins II
Flip Flop
Football 1
Football II
Fur Trader
Golf
Gomoko
Guess
Gunner
Hammurabi
Hangman
Hello
Hexapawn
Hi-Lo
High I-Q
Hockey

### Basic Games-2, CS-9002

Includes the Following:

Horserace
Hurkle
Kinema
King
Letter
Life
Life For Two
Literature Quiz
Love
Lunar LEM Rocket
Madlib
Mastermind
Math Dice
Mugwump
Name
Nicomachus
Nim
Number
One Check
Orbit
Pizza
Poetry
Poker
Qubic
Queen
Reverse
Rocket
Rock, Scissors, Paper
Roulette
Russian Roulette
Salvo
Sine Wave
Slalom
Slots
Splat
Stars
Stock Market
Super Star Trek
Synonym
Target
Trek Instructions
3-D Plot
3-D Tic Tac Toe
Tic Tac Toe
Towers
Train
Trap
23 Matches
War
Weekday
Word

## ADVENTURE

For Apple, TRS-80, Sorcerer, PET, CP/M

Wander through an enchanted world trying to recover 13 lost treasures. You'll encounter wild animals, magical beings, and many other perils and puzzles. Can you rescue the Blue Ox from the quicksand? Or find your way out of the maze of pits? Happy Adventuring!

**creative computing software**

### Basic Games-3, CS-9005

Includes the Following:

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Baccarat
Bible Quiz
Big 6
Binary
Blackbox
Bobstones
Bocce
Boga II
Bombrun
Bridge-it
Camel
Chase
Chuck-A-Luck
Close Encounters
Column
Concentration
Condot
Convoy
Corral
Countdown
Cup
Dealer's Choice
Deepspace
Defuse
Dodgem
Doors
Drag Race
Dr. Z
Eliza
Father
Flip
Geowar
Grand Prix
Guess-It
ICBM
Ink Blot
Joust
Jumping Balls
Keno
L Game
Life Expectancy
Lissajous
Magic Square
Man-Eating Rabbit
Maneuvers
Maze
Millionaire
Motorcycle Jump
Lewis

### Basic Games-4, CS-9006

Includes the Following:

Mastermind
Masterbagels
Matpuzzle
Minotaur
Nomad
Not One
Obstacle
Octrix
Pasart I
Pasart II
Patterns
Pinball
Rabbit Chase
Roadrace
Rotate
Safe
Scales
Schmoo
Seabattle
Seawar
Shoot
Smash
Strike 9
Tennis
Tickertape
TV Plot
Twonky
Two-to-Ten
UFO
Under & Over
U.S. Population
Van Gam
Warfish
Word Search Puzzle
Wumpus I
Wumpus II
Yahtzee
4-In-A-Row

## Special Packages

**Special package: BASIC Computer Games Book and Disks 1 and 2**
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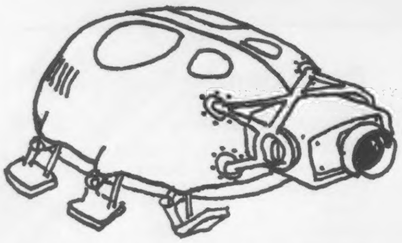
**Special package: More BASIC Computer Games Book and Disks 3 and 4**
**CS-9007**

**CS-9008**
**BASIC Computer Games Book, More BASIC Games Book and All four disks**

## 3 Fantastic CP/M Adventure Games!

See page 3



# Have You Been Bitten By The Computer Bug?

* * *

## Basic Computer Games

Edited by David Ahl, this book contains 101 imaginative and challenging games for one, two, or more players — Basketball, Craps, Gomoko, Blackjack, Even Wins, Super Star Trek, Bombs Away, Horserace. Simulate lunar landings. Play the stock market. Write poetry. Draw pictures.

All programs are complete with listing in Microsoft Basic, sample run and description. Basic conversion table included. 125,000 copies in print. 192 pages softbound. [6C] $7.50.

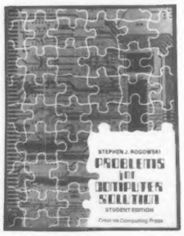
BASIC COMPUTER GAMES
MORE BASIC COMPUTER GAMES

## More Basic Computer Games

Contains 84 fascinating and entertaining games for solo and group play — evade a man-eating rabbit, crack a safe, tame a wild horse, become a millionaire, race your Ferrari, joust with a knight, trek across the desert on your camel, navigate in deep space.

All games come complete with program listing in Microsoft Basic, sample run and description. 192 pages softbound. [6C2] $7.50.

* * *



## Problems for Computer Solution

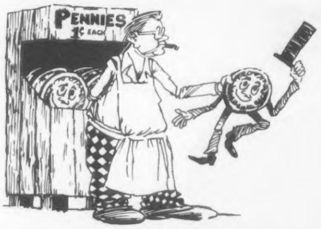
**Problems for Computer Solution** by Stephen J. Rogowski is an excellent source of exercises in research and problem solving for students and self-learners. Problems like the Faulty Speedometer Spotter make learning fun and easy. 104 pages, softbound, [9Z] $4.95.

The Best of creative computing
THE BEST OF creative computing

## The Best of Creative Computing

The first two years of **Creative Computing** magazine have been edited into two big blockbuster books. **American Vocational Journal** said of Volume 1, "This book is the 'Whole Earth Catalog' of computers." [6A] Volume 2 continues in the same tradition. "Non-technical in approach, its pages are filled with information, articles, games and activities. Fun layout." —**American Libraries.** [6B] Each volume $8.95.

* * *



## Computer Coin Games

**Computer Coin Games** by Joe Weisbecker aids newcomers to the field of computers by simplifying the concepts of computer circuitry through games which can be played with a few pennies and full sized playing boards in the book. Enhanced by outrageous cartoons, teachers, students and self-learners of all ages will enjoy this 96 page softbound book. [10R] $3.95.

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## Creative Computing Magazine

Creative Computing has long been Number 1 in applications and software for micros, minis, and time-sharing systems for homes, schools and small businesses. Loads of applications every issue: text editing, graphics, communications, artificial intelligence, simulations, data base and file systems, music synthesis, analog control. Complete programs with sample runs. Programming techniques: sort algorithms, file structures, shuffling, etc. Coverage of electronic and video games and other related consumer electronics products, too.

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* * *

## Computer Rage

This fun and educational new board game is based on a large-scale multiprocessing computer system. The object is to move your three programs from input to output. Moves are determined by the roll of three binary dice representing bits in a computer. Hazards include priority interrupts, program bugs, decision symbols, power failures and restricted input and output channels. Notes are included for adapting game for school instruction. A perfect introductory tool to binary math and the seemingly-complex computer. [6Z] **$8.95.**

* * *

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# You'll Get A BANG Out Of Sensational Software
## From Creative Computing

creative computing
software
PET (8k)
CS-1001
LOGIC GAMES — 1 (6 Games)

## A Word About Tape Quality

Since Creative Computing entered the software field in early 1978 we have learned, frequently the hard way, just how much is involved in the production of cassette tape software for computers. Three major factors are vital: recording, duplication, and tape quality.

Normal, high quality audio duplication does not yield consistently satisfactory results for computer cassettes. The reason for this begins in the computer itself. When a program is saved on tape, a series of audio signals is generated in the cassette interface and sent to the recorder. Unfortunately, accompanying the program signals are a variety of peripheral electronic noises emanating primarily from the CPU clock. The unwanted noises often cause cassette tapes to load improperly.

Tape quality for micro-computers is measured differently than quality for audio tape. The extremely sensitive tape favored by audiophiles is actually less satisfactory for computers than less sensitive tape because the sensitive tape tends to pick up more peripheral noise and send this unwanted electronic signal back to the computer when it is loaded.

Creative Computing cassette production begins with the creation of a high quality, half track, ¼" tape master. The tape master is then processed to filter out all unwanted noise in the audio signal. Volume level is adjusted at the time of processing. Creative Computing software tapes generally load at a lower than normal volume. This is because the unnecessary noise has been removed, and also because the loading volume has intentionally been reduced. Low cost cassette recorders distort at higher volume levels, hence our cassettes are made to load at lower volume levels.

Once the master tape has been created the actual cassettes are produced. High speed in-cassette duplication can cause the stretching of tapes. Hence, Creative Computing cassettes are recorded first on bulk tape, then loaded into the cassette housing. In a further effort to control tape quality, samples from each batch are tested before any are shipped out.

Creative Computing works hard at offering the highest quality product at the lowest price. Our attention to details in tape production, clear and concise documentation, state-of-the-art programs and personal service are for your benefit. It is our goal to be number 1 in software by providing the best value per dollar. The effort applied towards improving tape production techniques is just one of the ways in which we are working towards this objective.

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Creative Computing Software is available
from your local computer store.

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sensational
software

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software

# Philadelphia Computer Music Festival

### Dick Moberg

## What Is Computer Music?

Computer music can be defined as a type of electronic music which is produced either directly by a computer or indirectly by a computer-controlled synthesizer. Computers can produce a sound directly by storing the waveform of that sound as a series of varying numbers in its memory and then converting these numbers to voltages to drive a speaker. The string of numbers can be manipulated by the computer at very fast speeds which accounts for the amazing flexibility of computer synthesized music.

Although, theoretically, any sound could be produced in this manner, the programming can get rather tedious. But computers are also being used to sequence and to control the parameters of conventional synthesizer circuits. This is much easier, but perhaps a bit less flexible, than directly computing each waveform. This latter technique is the most popular today and accounts for most of the music on this album.

## The Personal Computer Music Revolution

I often wonder what music will be like after the microelectronics revolution puts a computer in every home. But why should computers change things? Up until this time music listening has been just that — passive listening to recordings of music. But with computers we all become "sound explorers" because we can now take an active part in changing the music we hear or to compose our own. We can master any instrument's sound without the years of tedious practice or we can create our own "instruments"; combinations of conventional ones or entirely new ones.

The technology to do all this is here today and the mass production and availability of personal computers is being felt by the public as never before. We are truly at the dawn of the personal computer music revolution. Just as the radio brought music listening to the masses, so will computers bring music composition and exploration to them too.

## About The Personal Computer Music Festival

Early in 1978, I received a call from John Dilks asking me if there were anything that our Computer Society wanted to do for his show. John was organizing the Personal Computing '78 Show which our Society was hosting in Philadelphia that year. Several people in the area had been producing music with their computers so I suggested we have a computer music concert. John OK'd the idea and we went to work calling our friends and urging them to perform.

By summer the local response was not as great as we had anticipated. Many of the computer musicians were reluctant or too shy to perform at a computer music concert, something they had never heard of before. But word of the concert had spread and a steady stream of calls from all over the country began to come in. Hal Chamberlin, one of the early computer music pioneers, agreed to come as did Carl Helmers (editor of Byte Magazine), Dave Ahl (publisher of Creative Computing), and Malcolm Wright (engineer at Solid State Music in California). Dorothy Siegel called from New York to say she was arranging a piece for computer and clarinet specially for the concert! Rick Simpson from RCA had a number of pieces to play on their new computer and some would be accompanied by an "engineer-flutist" they had at RCA.

Plans for the Festival quickly grew beyond what we had originally anticipated. Fortunately, we acquired some very talented volunteers from the Computer Society to meet the new demands placed upon us. The dedication of this small group made the Festival the success it was.

The concert was finally held in one of the larger ballrooms of the Sheraton Hotel. Our borrowed sound system was set up and sound checks made for the recording. We opened the doors to the crowd outside to find several hundred more people than the room could hold. Many sat on the floors of the halls as the music filled the hotel.

Hal Chamberlin had set up an oscilloscope that would project the waveform being played on a screen. The result was a fantastic synchronized light show! Part of the concert was filmed by TV Ontario's Fast Forward Office for use in a special series on personal computing. This was perhaps the first concert to be held which featured music synthesized using personal computer systems. The concert lasted close to 3 hours and the room was still packed when the last piece was played. This recording features highlights from the concert.

creative computing
CR101
First Philadelphia Computer Music Festival
8 Music Synthesizers
play music by
J.S. Bach
J. Pachelbel
Rimsky-korsakov
Scott Joplin
Neil Diamond
Lennon & McCartney
and 7 more.
Recorded Live

## 12" LP Record

A recording was made of the festival and is now available on a 12" LP record. It features eight different computer music synthesizers programmed to play the music of J.S. Bach, J. Pachelbel, Rimsky-korsakov, Scott Joplin, Neil Diamond, Lennon & McCartney and seven others. The music ranges from baroque to rock, traditional to rag and even includes an historic 1963 computerized singing demonstration by Bell Labs.

The record is available for $6.00 postpaid ($7.00 foreign) from Creative Computing, P.O. Box 789-M, Morristown, NJ 07960.

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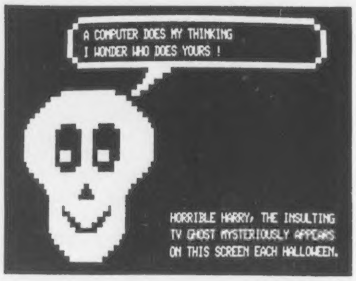
Dick Moberg, Philadelphia Area Computer Society, Box 1954, Philadelphia, PA 19105.

# Your Own Insulting Halloween Ghost

HORRIBLE
HARRY

### Joe Weisbecker



A COMPUTER DOES MY THINKING
I WONDER WHO DOES YOURS !

HORRIBLE HARRY, THE INSULTING
TV GHOST MYSTERIOUSLY APPEARS
ON THIS SCREEN EACH HALLOWEEN.

*Let Horrible Harry add a new, insulting twist to your Halloween this year!*

This wisecracking TV ghost can be the hit of your home this Halloween. He'll insult everyone, roll his eyes, and make you the most popular house on the block. The computer program that causes old Horrible to materialize on your TV screen was designed to run on a Level II TRS-80 computer. A similar program could be developed for any home computer with video graphics capability. The graphics and wisecracks provided here can be used as the basis for such programs.

This Horrible Harry program illustrates that you don't have to be a programming expert to have fun with your computer. You should even be able to improve the program by adding new features. Some of these new features will be discussed later. In the meantime you have a program you can use this Halloween as well as a starting point for developing your own TV ghost program for next Halloween.

#### Harry's Roots

One Halloween, when our children were much younger, my wife and I set up a two-way closed circuit TV system between the basement and living room. I sat in the basement manipulating a plastic talking skull which appeared on the TV set in the living room. I could also observe the children in the living room who were watching and listening to the haunted TV set. The reactions of some of the younger children were amazing. The fact that the skull on the TV set was kidding around with them was taken for granted. Only one child out of a hundred was mildiy scared of the skull. One young girl actually kissed the screen goodbye. Another child ran home and pulled his father away from dinner to come back with him to see the TV ghost. We were subsequently confronted by a six foot tall, bearded, hungry father stating that "This better be worth missing dinner for." Fortunately, he thought it was. Years later we were still being asked about our TV ghost.

A two-way closed circuit TV system together with rewiring the house might be too much effort for most readers. Instead, you can easily let your home computer create a TV ghost that will insult the neighborhood kids this Halloween. You could also take Horrible Harry to your October computer club meeting or make him the host of a Halloween party.

#### How Harry Works

You need to understand how the program works so that you can modify or expand it later. At line 16 Horrible Harry is drawn on the screen by calling the subroutine at line 60. This subroutine uses the data in lines 100 to 122. The data is organized in groups of three numbers. In each group of three numbers, the first number specifies the X-coordinate of the left end of a horizontal line to be drawn on the TV screen. The second number in the group of three represents the right end of the line. The third number in each group is the Y-coordinate of the horizontal line that is to be drawn. Horrible Harry was first drawn on a TRS-80 Video Display Worksheet and then coded as a series of horizontal lines according to the above system.

After Horrible Harry is drawn on the screen, the program repeats the loop comprising lines 18 to 34. At line 18 any previous insult is erased by the subroutine at line 220. The subroutine at 230 causes Harry to move his eyes back and forth several times before coming up with his next wisecrack. The fourteen snappy sayings are selected in sequence by lines 20 to 26. The first line of a wisecrack is shown followed by a delay. The subroutine at line 50 provides this delay and positions the cursor to print the punch line. After showing the punch line, control is returned to line 30 where the subroutine at 260 is executed. This subroutine causes Harry to roll his eyes before returning to line 18 in preparation for the next witticism.

Fourteen hilarious wisecracks are provided in lines 501 to 528. Each is two lines long. Look at lines 501 and 502 to see the format for each saying. Make sure you follow this exact format if you decide to change Horrible Harry's repertoire of snappy sayings. If you want Horrible Harry to deliver his insults randomly instead of in sequence, just change line 20 to X = RND(14).

#### Twelve More Horrible Quips

Here are some more snappy sayings for you to put in Harry's mouth. They have been borrowed from many sources and tested on typical TV audiences. You should feel

Joe Weisbecker, 1220 Wayne Ave., Cherry Hill, NJ 08002.

## Horrible Harry, con't...

free to write your own material for Horrible Harry.

1. I wish I'd known you before you passed away!
2. I heard that mind readers only charge you half price!
3. The maggots arguing in the mortuary fought it out in dead Ernest!
4. I'll get an electronic engineer to do shocking things to you!
5. If that's your real face you've got more problems than me!
6. If I was building an idiot you'd make a perfect model!
7. Somebody told me you're so tight that you squeak when you walk!
8. The last time I saw a face like yours a jockey was bending over it!
9. You look like my dear departed uncle two years after he departed!
10. I hope you didn't look that bad when you were alive!
11. Here's an example of mind over matter: I don't mind and you don't matter!
12. I'll just call you Webster since words can't describe you!

### Moving Right Along

Now we're getting to the good part... where you have to do some work. So far, Harry just sits there insulting his victims. Why not let Harry do imitations too? An imitation of Vincent Price as the Invisible Man is easy. Just erase Harry. Leave the speech balloon visible and after Harry disappears you can have him say "Press key 1 to turn me on." After someone presses key 1 Harry reappears on the screen.

You could have Harry say "BOO" in a loud voice. This would involve using POKE statements with graphic character codes to spell out "BOO" in large letters.

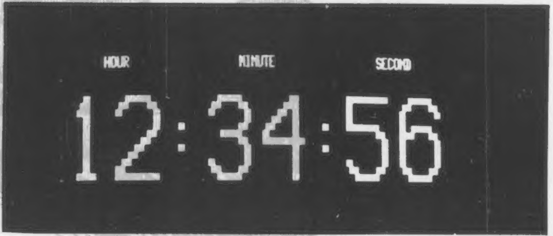
With a little more effort you can even make Harry interact with his victims. They can type in their name and Harry can deliver personalized insults. If you want to use Harry at a club meeting or party some really impressive possibilities exist since you will know the people involved. You can put in a list of names along with insults tailored to each name. When the victims type in their names, Harry can recognize exactly which insults will be appropriate. If you follow through on this idea you should be prepared to lose a few friends.

Horrible Harry is one small attempt to put some much needed fun back into home computing. If God meant computers to be taken seriously she certainly wouldn't have given them bouncy keyboards. ☐

```
6 'HORRIBLE HARRY - COPYRIGHT 1979 BY JOE WEISBECKER
8 CLS:RANDOM
10 PRINT@865,"HORRIBLE HARRY, THE INSULTING"
12 PRINT@929,"TV GHOST MYSTERIOUSLY APPEARS"
14 PRINT@993,"ON THIS SCREEN EACH HALLOWEEN."
16 GOSUB60
17 LETX=0
18 GOSUB220:GOSUB230
20 X=X+1:IFX=15THENX=1
21 PRINT@81,"";
26 ONXGOSUB501,503,505,507,509,511,513,515,517,519,521,523,525,527
30 GOSUB260
32 FORN=1TO200:NEXTN
34 GOTO18
50 GOSUB210:E=15822:GOSUB200
52 FORN=1TO2000:NEXTN
54 PRINT@145,"";:RETURN
60 RESTORE:POKE15438,191:POKE15502,143
62 POKE15484,191:POKE15548,143
64 FORN=1TO72:GOSUB70:NEXTN
66 E=15885:GOSUB200:RETURN
70 READA,B,Y
72 FORX=ATOB:SET(X,Y):NEXTX
74 RETURN
100 DATA32,117,1,30,31,2,118,119,2,30,31,8,118,119,8,32,117,9
102 DATA58,65,10,57,62,11,56,59,12,54,57,13,26,45,14,52,54,14
104 DATA22,49,15,20,51,16,18,53,17,16,55,18,14,57,19,13,25,20
106 DATA32,39,20,46,58,20,12,23,21,34,37,21,48,59,21,12,23,22
108 DATA34,37,22,48,59,22,12,23,23,34,37,23,48,59,23,12,23,24
110 DATA34,37,24,48,59,24,12,23,25,34,37,25,48,59,25,12,23,26
112 DATA34,37,26,48,59,26,13,23,27,34,37,27,48,58,27,14,25,28
114 DATA32,39,28,46,57,28,16,55,29,18,53,30,20,34,31,37,51,31
116 DATA21,33,32,38,50,32,22,32,33,39,49,33,22,49,34,22,26,35
118 DATA28,43,35,45,49,35,22,26,36,30,41,36,45,49,36,22,28,37
120 DATA32,39,37,43,49,37,22,29,38,34,37,38,42,49,38,22,31,39
122 DATA40,49,39,23,48,40,24,47,41,26,45,42,28,43,43,30,41,44
200 POKE E,188:POKE E+1,188
202 POKE E+7,188:POKE E+8,188
204 FORN=1TO20:NEXTN
206 RETURN
210 POKE E,128:POKE E+1,128
212 POKE E+7,128:POKE E+8,128:RETURN
220 FORN=15440TO15482:POKEN,128:NEXTN
222 FORN=15504TO15546:POKEN,128:NEXTN
224 RETURN
230 FORK=1TO10
232 GOSUB210:E=15885:GOSUB200
234 FORR=1TO2
238 GOSUB210:E=E+1:GOSUB200:NEXTR
240 FORR=1TO3
244 GOSUB210:E=E-1:GOSUB200:NEXTR
248 GOSUB210:E=E+1:GOSUB200
250 NEXTK:RETURN
260 FORK=1TO10
262 GOSUB210:E=15885:GOSUB200
266 GOSUB210:E=15821:GOSUB200
270 GOSUB210:E=15822:GOSUB200
274 GOSUB210:E=15886:GOSUB200
276 NEXTK:RETURN
501 PRINT"I AIN'T GOT NO BODY BUT I CAN SEE";:GOSUB50
502 PRINT"THAT YOU'RE NOT ALL THERE EITHER !";:RETURN
503 PRINT"SKELETONS ARE JUST BONES";:GOSUB50
504 PRINT"WITH THE PEOPLE SCRAPED OFF !";:RETURN
505 PRINT"DON'T FALL DOWN OR YOU'LL";:GOSUB50
506 PRINT"KNOCK YOURSELF CONSCIOUS !";:RETURN
507 PRINT"A COMPUTER DOES MY THINKING";:GOSUB50
508 PRINT"I WONDER WHO DOES YOURS !";:RETURN
509 PRINT"WHATEVER MAKES YOU STUPID";:GOSUB50
510 PRINT"REALLY WORKS GOOD !";:RETURN
511 PRINT"YOUR LEFT EYE MUST BE FASCINATING";:GOSUB50
512 PRINT"YOUR RIGHT ONE KEEPS WATCHING IT !";:RETURN
513 PRINT"I HEARD YOU'RE SO DUMB THAT YOU";:GOSUB50
514 PRINT"STUDIED FOR YOUR LAST BLOOD TEST !";:RETURN
515 PRINT"MY CAT EATS CHEESE AND SITS";:GOSUB50
516 PRINT"BESIDE MOUSEHOLES WITH BAITED BREATH !";:RETURN
517 PRINT"I WAS GOING TO DO MY IDIOT IMITATION";:GOSUB50
518 PRINT"BUT YOU BEAT ME TO IT !";:RETURN
519 PRINT"WATCHING TV IS TERRIBLE BUT";:GOSUB50
520 PRINT"WATCHING YOU IS WORSE !";:RETURN
521 PRINT"MAYBE NEXT YEAR I'LL COME OVER";:GOSUB50
522 PRINT"AND HAUNT YOUR TV";:RETURN
523 PRINT"WHEN I HEARD MY SISTER SCREAM,";:GOSUB50
524 PRINT"I QUICKLY THREW HER IN THE STREAM !";:RETURN
525 PRINT"I HEARD THAT WHEN SNAKES GET DRUNK";:GOSUB50
526 PRINT"THEY SEE YOU !";:RETURN
527 PRINT"I HEAR THAT BACKING INTO THE COMPUTER";:GOSUB50
528 PRINT"PUT YOU A LITTLE BEHIND IN PROGRAMMING !";:RETURN
529 END
```

**When your TRS-80 is "resting"...**

# Graphics Digital Clock



The TRS-80 graphics display of time.

## Delmer Hinrichs

Are you tired of looking at the blank face of your TRS-80's monitor when you're not computing? Do you want to give it something useful that it can do all by itself? Then try this program! It's a 12 or 24 hour digital clock, using TRS-80 graphics. It gives a continuous display of the time as Hours : Minutes : Seconds in large, 4 centimeter high numbers, as shown in the photo.

### Digital Clock Program

The program as listed requires about 4500 bytes of memory to run, but it does not need the real time clock that is in the expansion interface. To use the program, first load it into your TRS-80, either from cassette tape or from the keyboard, and enter RUN. Then specify whether you want it to run as a 12 hour clock or as a 24 hour clock. Then key in the time that you will start the clock (hour, comma, minute, comma, second), but **do not** press ENTER yet. At the exact time that you specified, press ENTER to start the digital clock. Illegal entries give an error message and a chance to try again.

As listed, the program gives the correct time to within a fraction of a second per day on my TRS-80. If your TRS-80 has a slightly different crystal frequency, you may have to adjust the program to run faster or slower. The digital clock timing is controlled by three delay loops:

1. The "seconds" delay loop in line 280 is currently set to 199. Each unit change causes about 15 seconds per hour timing change. That is, a change to 198 would make the clock run about 15 seconds per hour faster, while a change to 200 would make the clock run about 15 seconds per hour slower.
2. The "minutes" delay loop in line 310 is currently set to 26. Each unit change causes about ¼ second per hour timing change.
3. The "hours" delay loop in line 340 is currently set to 8. Each unit change causes about 0.1 second per day timing change.

Note that **any** change in the program, even leaving out a space or inserting a space, may change the program's timing, and require resetting of the delay loops.

The digital clock actually runs slightly fast while counting seconds, then is corrected by the "minutes" delay loop. It again runs slightly fast while counting minutes, then is corrected by the "hours" delay loop. In adjusting the digital clock delay loops, the count in the "minutes" or "hours" delay loops should not exceed 60; if it needs to be greater, instead set it back to 1, and increment the preceding delay loop count by 1.

If you are using the 24 hour digital clock format, you may want to change the subroutine call of 890 to 900 in program line 170. This will give the standard, leading zero 24 hour time format.

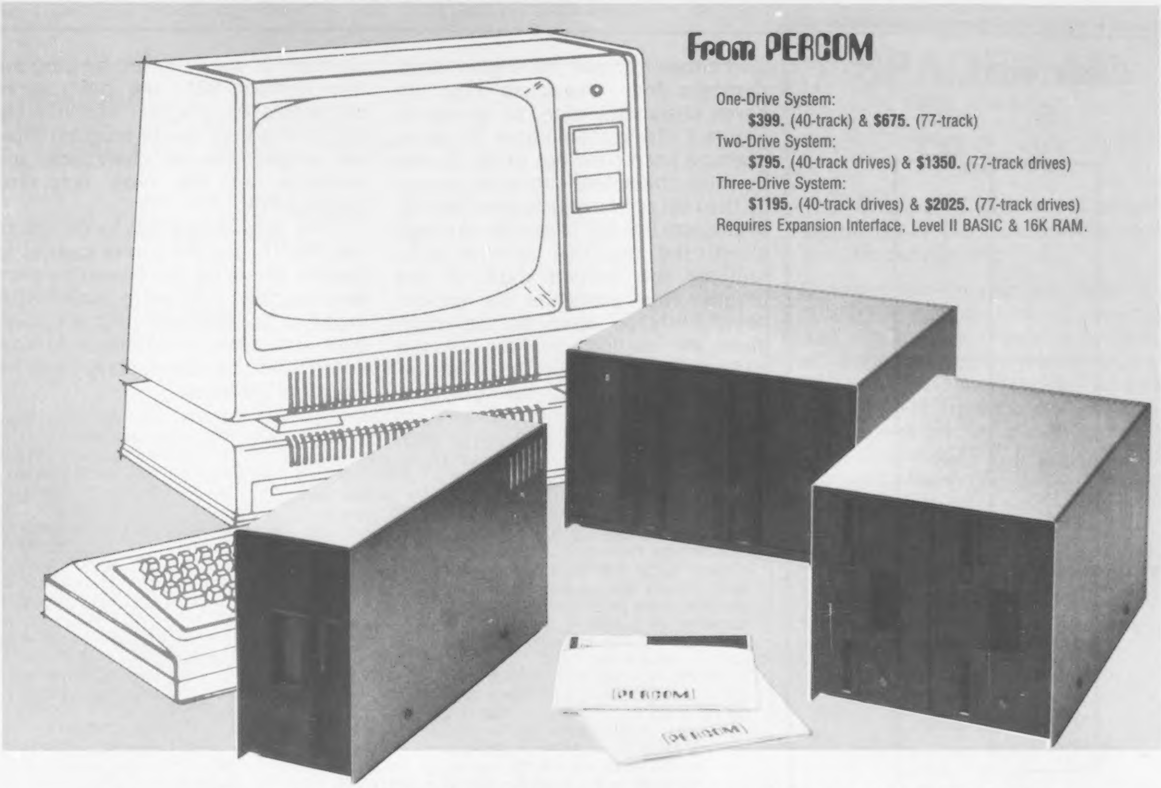
### TRS-80 Graphics

How do those strange-looking graphics subroutines in the program work? They are actually rather easy to set up. You may want to use similar graphics methods in your own programs. You recall that the regular TRS-80 graphics, using SET and RESET, can individually access any graphics block on a 128 by 48 field. This system, while very flexible, is too slow to write the numbers for the digital clock. We can greatly speed up the graphics writing by specifying a whole graphics character (six graphics blocks) at a time. But how can we do this?

The TRS-80 graphics are printed one character at a time rather than a block at a time. Each character is about three times as high as it is wide and includes six graphics blocks as shown in Figure 1. When you specify a change of one graphics block the BASIC graphics routines must determine which position in which character is to be changed. The new character is PRINTed after changing. Sometimes you know ahead of time what all of the graphics blocks should be as you do with this fixed set of numbers. Then you can specify each character directly and bypass those time-consuming routines for individual graphics blocks. But how can we specify the characters?

The 64 possible graphics characters are designated on the TRS-80 by the ASCII (American Standard Code for Information Interchange) numbers from 128 to 191. The number 128 indicates that no blocks are to be set on, while the number 191 indicates that all six blocks are to be set on. All other possibilities are specified by adding up all of the numbers in Figure 1 corresponding to blocks to be set on, and adding that sum to 128. For example, if the two top blocks of a character are to be set on, then add 1, 2 and 128 to get the ASCII number of 131. Then to display this character, convert the ASCII number to the corresponding character by using CHR$, and PRINT it. Now we can PRINT one graphics character or six graphics blocks at a time. What about a whole digital clock number?

Delmer Hinrichs, 2116 SE 377th Ave., Washougal, WA 98671.



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## Clock, con't...

I chose to make my digital clock numbers four characters high by seven characters wide, as shown in Figure 2. Using the number "2" as an example I sketched out which blocks in which characters should be turned on then set up the subroutine starting at program line 920 to do this. As with all of the graphics number subroutines the second digit of the program line number is the number being PRINTed while the last digit gives the vertical position of the characters being PRINTed. The top seven characters of the graphics number "2" are PRINTed by program line number 921, the next seven characters by program line number 922, and so on. Some program lines are longer than 64 characters and continue on the next displayed program line.

The only things left to do are to use PRINT for the cursor control to specify where on the screen to print each number, then write nested FOR loops to control updating the numbers, and presto, a digital clock! Now your TRS-80 can be working away for you all of the "time." □

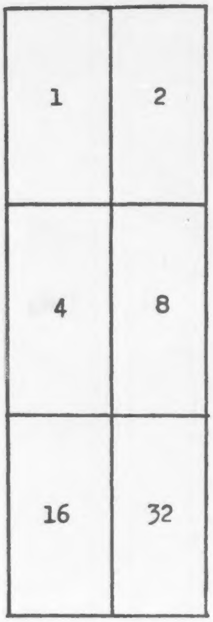

Figure 1. The six graphics blocks in a single character. The numbers in each block are added to 128 to give the ASCII number that will turn on that block.

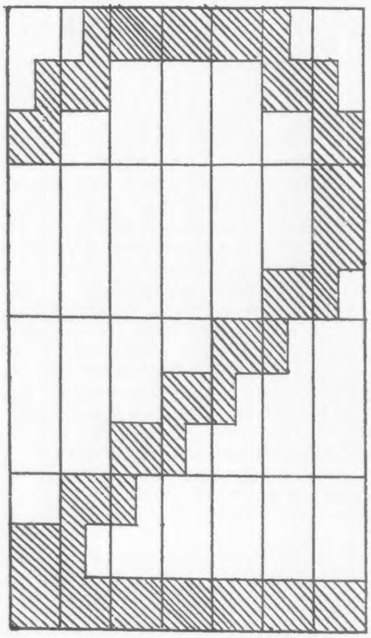

Figure 2. The 28 characters used for the graphics number "2." The whole graphics number is 7 characters wide by 4 high.

```
10 CLS : PRINT "*   *   *   *   DIGITAL CLOCK   *   *   *   *"
20   '             BY D. D. HINRICHS FOR TRS-80 LEVEL II BASIC
30 DEFINT A-Z : T=10 : PRINT
40 INPUT "ENTER '12' FOR 12-HOUR, OR '24' FOR 24-HOUR CLOCK"; Z
50 IF Z=12 THEN A=1 : B=13 : C=1 : D=2 : PRINT : GOTO 80
60 IF Z=24 THEN A=0 : B=24 : C=2 : D=3 : PRINT : GOTO 80
70 PRINT"YOUR ENTRY OF "; Z; " IS ILLEGAL.  TRY AGAIN" :GOTO 30
80 INPUT "ENTER TIME YOU WILL START (HR, MIN, SEC)" ; H, M, S
90 IF H>=A AND H<B AND M>=0 AND M<60 AND S>=0 AND S<60 GOTO 120
100 PRINT "YOUR ENTRY OF"; H ; "HR, "; M ; "MIN, "; S ; "SEC ";
110 PRINT "IS ILLEGAL.   TRY AGAIN" : PRINT : GOTO 80
120 H1=H/T :H2=H-H1*T :M1=M/T :M2=M-M1*T :S1=S/T :S2=S-S1*T+1
130 CLS : PRINT@ 199, "HOUR                          MINUTE                        SECOND"
140 PRINT@ 403, CHR$(140) : PRINT@ 427, CHR$(140)    '  COLONS
150 PRINT@ 467, CHR$(140) : PRINT@ 491, CHR$(140)
160 FOR D1=H1 TO C : S=321  '  TENS OF HOURS
170  ON D1+1 GOSUB 890,910,920
180  FOR D2=H2 TO 9 : S=329  '  HOURS
190   ON D2+1 GOSUB 900,910,920,930,940,950,960,970,980,990
200   FOR D3=M1 TO 5 : S=344  '  TENS OF MINUTES
210    ON D3+1 GOSUB 900,910,920,930,940,950
220    FOR D4=M2 TO 9 : S=353  '  MINUTES
230     ON D4+1 GOSUB 900,910,920,930,940,950,960,970,980,990
240     FOR D5=S1 TO 5 : S=367  '  TENS OF SECONDS
250      ON D5+1 GOSUB 900,910,920,930,940,950
260      FOR D6=S2 TO 9 : S=376  '  SECONDS
270       ON D6+1 GOSUB 900,910,920,930,940,950,960,970,980,990
280       FOR I=1 TO 199 : NEXT I  '  DELAY LOOP, SECONDS
290      NEXT D6 : S2=0
300     NEXT D5 : S1=0
310     FOR I=1 TO 26 : NEXT I  '  DELAY LOOP, MINUTES
320    NEXT D4 : M2=0
330   NEXT D3 : M1=0
340   FOR I=1 TO 8 : NEXT I  '  DELAY LOOP, HOURS
350   IF D1=C AND D2=D GOTO 380
360  NEXT D2 : H2=0
370 NEXT D1
380 H1=0 : H2=A : GOTO 160
390 END
400   '
410   '  ALL GRAPHICS NUMBER SUBROUTINES AFTER THIS
420   '
890   '  BLANK
891 PRINT@ S, "       "; : PRINT@ S+64, "       ";
892 PRINT@ S+128, "       "; : PRINT@ S+192, "       ";
893 RETURN
900   '  ZERO
901 PRINT@ S, CHR$(184); CHR$(142); STRING$(3,CHR$(131));          CHR$(141); CHR$(180);
902 PRINT@ S+64, CHR$(191); "     "; CHR$(191);
903 PRINT@ S+128, CHR$(191); "     "; CHR$(191);
904 PRINT@ S+192, CHR$(139); CHR$(172); STRING$(3,CHR$(176));      CHR$(156); CHR$(135);
905 RETURN
910   '  ONE
911 PRINT@ S, "  "; CHR$(184); CHR$(191); "   ";
912 PRINT@ S+64, "   "; CHR$(191); "   ";
913 PRINT@ S+128, "   "; CHR$(191); "   ";
914 PRINT@ S+192, "  "; CHR$(176); CHR$(191); CHR$(176); "  ";
915 RETURN
920   '  TWO
921 PRINT@ S, CHR$(184); CHR$(142); STRING$(3,CHR$(131));          CHR$(141); CHR$(180);
922 PRINT@ S+64, "     "; CHR$(176); CHR$(159);
923 PRINT@ S+128, "  "; CHR$(176); CHR$(156); CHR$(135);           CHR$(129); " ";
924 PRINT@ S+192, CHR$(188); CHR$(183); CHR$(177); STRING$(4,      CHR$(176));
925 RETURN
930   '  THREE
931 PRINT@ S, CHR$(184); CHR$(142); STRING$(3,CHR$(131));          CHR$(141); CHR$(180);
932 PRINT@ S+64, "  "; STRING$(3,CHR$(176)); CHR$(156);            CHR$(135);
```

Listing of the TRS-80 digital clock program which gives a graphics display of the time.

## Clock, con't...

```
933 PRINT@ S+128, "     "; CHR$(131); CHR$(189);
934 PRINT@ S+192, CHR$(139); CHR$(172); STRING$(3,CHR$(176));       CHR$(156); CHR$(135);
935 RETURN
940   ' FOUR
941 PRINT@ S, "  "; CHR$(160); CHR$(184); CHR$(142); CHR$(191);     " ";
942 PRINT@ S+64, CHR$(184); CHR$(142); CHR$(131); "  ";             CHR$(191); " ";
943 PRINT@ S+128, STRING$(5,CHR$(131)); CHR$(191); CHR$(131);
944 PRINT@ S+192, "     "; CHR$(191); " ";
945 RETURN
950   ' FIVE
951 PRINT@ S, CHR$(191); STRING$(6,CHR$(131));
952 PRINT@ S+64, CHR$(143); STRING$(4,CHR$(140)); CHR$(180),        CHR$(144);
953 PRINT@ S+128, "      "; CHR$(191);
954 PRINT@ S+192, CHR$(139); CHR$(172); STRING$(3,CHR$(176));       CHR$(156), CHR$(135);
955 RETURN
960   ' SIX
961 PRINT@ S, CHR$(184); CHR$(142); STRING$(3,CHR$(131));           CHR$(141); CHR$(180);
962 PRINT@ S+64, CHR$(191); CHR$(176); CHR$(156); CHR$(140),        CHR$(140), CHR$(180); CHR$(144);
963 PRINT@ S+128, CHR$(191); "     "; CHR$(191);
964 PRINT@ S+192, CHR$(139); CHR$(172); STRING$(3,CHR$(176));       CHR$(156); CHR$(135);
965 RETURN
970   ' SEVEN
971 PRINT@ S, CHR$(143); STRING$(4,CHR$(131)); CHR$(163);           CHR$(191);
972 PRINT@ S+64  "  "; CHR$(160); CHR$(184); CHR$(142);             CHR$(131); " ";
973 PRINT@ S+128, " "; CHR$(184); CHR$(135); "    ";
974 PRINT@ S+192, CHR$(190); CHR$(129); "     ";
975 RETURN
980   ' EIGHT
981 PRINT@ S, CHR$(184); CHR$(142); STRING$(3,CHR$(131));           CHR$(141); CHR$(180);
982 PRINT@ S+64, CHR$(139); CHR$(172); STRING$(3,CHR$(176));        CHR$(156); CHR$(135);
983 PRINT@ S+128, CHR$(190); CHR$(131); "   "; CHR$(131);           CHR$(189);
984 PRINT@ S+192, CHR$(139); CHR$(172); STRING$(3,CHR$(176));       CHR$(156); CHR$(135);
985 RETURN
990   ' NINE
991 PRINT@ S, CHR$(184); CHR$(142); STRING$(3,CHR$(131));           CHR$(141); CHR$(180);
992 PRINT@ S+64, CHR$(175); CHR$(176); "  "; CHR$(160);             CHR$(176); CHR$(191);
993 PRINT@ S+128, " "; CHR$(130); STRING$(3,CHR$(131)); " ";        CHR$(191);
994 PRINT@ S+192, CHR$(139); CHR$(172); STRING$(3,CHR$(176));       CHR$(156); CHR$(135);
995 RETURN
```

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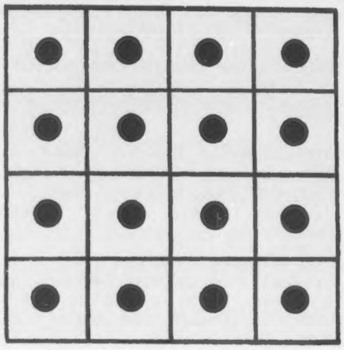
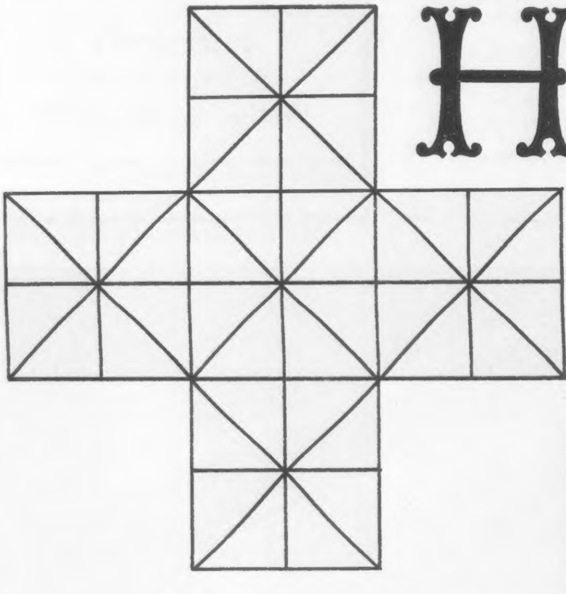
# puzzles & problems



Merlin's first puzzle this month is a tricky piece of Flatland puzzlement. Without lifting your pencil from the paper, you are to draw six straight lines which will pass through all sixteen dots in the diagram.

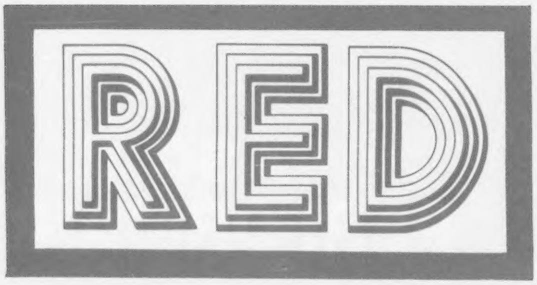
* * *

From Greg Hofmann, of Venice, California, we have the following confusing question to answer. "When the day after tomorrow is yesterday, then 'today' will be as far from Sunday as that day was which was 'today' when the day before yesterday was tomorrow. What day is it?" Thank you Mark, a copy of "Merlin's Puzzler" is on the way.



Here is one of those puzzles that look deceptively easy, but often prove to be the most difficult. You must figure out how many different squares are contained in the drawing on the left, and, how many different triangles are also hidden within its confines. You are allowed only one chance to arrive at the correct totals.

Below is an interesting picture which is really a nine word riddle that askes you to identify an ordinary object that is found around the house. What is the riddle, and, what is this elusive object?



What common English word, in use today, will describe a person or a thing as being in no place under the sun, neither here, nor there, nor anywhere. Yet, if you add only a space between two of its letters, you will correctly describe the person or object as being right here at this very moment. Can you tell me what this word is?

* * *

On the next page Merlin gives you one of the secrets behind the construction of mathematical magic squares. You should have fun devising programs that can make use of this "secret" formula. Don't forget to send in your favorite puzzles to Merlin. If he uses your puzzle he will send you a free copy of one of his books.

In "Merlin's Puzzler, Vol. 2" Merlin took the reader on a trip to England's home of mystery during the Victorian period, the famous "Egyptian Hall." The following account records the marvelous computer that they saw there.

"Look at this sign, 'Maskelyne and Cooke's Wonder Of The Age', an electronic computer that solves forever that mathematical mystery, the Magic Square. It goes on to say that the 'MAC' computer, which is locked in the basement vault of the Egyptian Hall, is connected by wires to the typewriter on this table. This is all very hard to believe, you know, even if it is 1890. Let's see now; it says that Mr. Cooke, who is at the table, can communicate with MAC by using that telegraph key in front of him. He will relay any number that you give him, say between 40 and 100, and the computer will immediately calculate the square and print it out on the Columbia Typewriter for you. This I have got to see! "Mr. Cooke, I challenge that infernal machine of yours to construct a square using my age, 47, as the magic number."

"I assure you, sir, that if your age were 147 or a biblical 1047, MAC would not fail. Stand back and witness the wonder of this or any other age, big MAC."

"Well, bless my soul, look at that. The typewriter has come alive, and look, it is printing a Magic Square. Why, I don't believe my eyes, it seems to total 47 in every direction. Now how did they do it, man, how did they do it?"

"Mr. Cooke has graciously consented to let the readers of Merlin's Puzzler in on the secret of creating a Magic Square. In figure 2 you will find the secret mathematical formula needed to work this puzzle out. Follow closely: Take the number 47 (remember that you can do this with any number greater than 40); subtract 30 from it; divide the difference (17) by 4. This will leave you with a dividend of 4 and a remainder of 1. Next, look at Fig. 1. In each one of the squares you will find a number in a circle (except for square D). This is the initial value of the square. You must add the dividend (4) to this value to get the final value for the square. For square D you must enter only the value of the dividend, (4). In the four squares that have a plus sign (+) next to the circled initial amount (squares C,E,J,P), you must also add the remainder (1) from your calculation to get the final value for the square. Our sample square would be: (A) 7+4=11, (B) 10+4=14, (C) 13+4+1=18, (D) 0+4=4, (E) 12+4+1=17, (F) 1+4=5, (G( 6+4=10, (H) 11+4=15, (I) 2+4=6, (J) 15+4+1=20, (K) 8+4=12, (L) 5+4=9, (M) 9+4=13, (N) 4+4=8, (O) 3+4=7, (P) 14+4+1=19.

You can make up squares for very large numbers, say the year you were born. With a little practice, and some memorizing, you can actually learn to do this in your head. Why, you might even bill yourself as "The Eighth Wonder of the World, the Walking Computer."

Your editor,

Charles Barry Townsend

Answers on page 192.

| | | | |
|---|---|---|---|
| A<br>⑦ | B<br>⑩ | C<br>⑬+ | D |
| E<br>⑫+ | F<br>① | G<br>⑥ | H<br>⑪ |
| I<br>② | J<br>⑮+ | K<br>⑧ | L<br>⑤ |
| M<br>⑨ | N<br>④ | O<br>③ | P<br>⑭+ |

Fig. 1

THE SECRET MATHEMATICAL FORMULA

GIVEN NUMBER 47
ALWAYS SUBTRACT 30
DIVIDE BY 4 (17( 4 DIVIDEND
16
1 REMAINDER

Fig. 2

| | | | |
|---|---|---|---|
| A<br>11 | B<br>14 | C<br>18 | D<br>4 |
| E<br>17 | F<br>5 | G<br>10 | H<br>15 |
| I<br>6 | J<br>20 | K<br>12 | L<br>9 |
| M<br>13 | N<br>8 | O<br>7 | P<br>19 |

Fig. 3

# Trigonometric Functions and Tchebychev Approximations

## (Or—Can a humble computer that only knows how to do arithmetic calculate transcendental functions?)

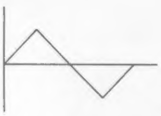
Problem 1. Below you see three representations of the "sine" function. Which is the right one?

- ☐ 1. (a)
- ☐ 2. (b)
- ☐ 3. (c)
- ☐ 4. All of the above.
- ☐ 5. None of the above.

(a) The SINE function:

| Y | Y/R |
|---|---|
| 0.0 | 0.000 |
| 0.1 | 0.100 |
| 0.2 | 0.200 |
| 0.3 | 0.300 |
| 0.4 | 0.400 |

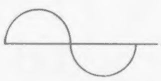
etc.



(b) The SINE function:

| X | $\pm\sqrt{(R^2-X^2)}/R$ |
|---|---|
| 1.0 | 0.000 |
| 0.9 | 0.436 |
| 0.8 | 0.600 |
| 0.7 | 0.714 |
| 0.6 | 0.800 |

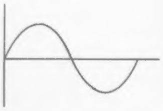
etc.

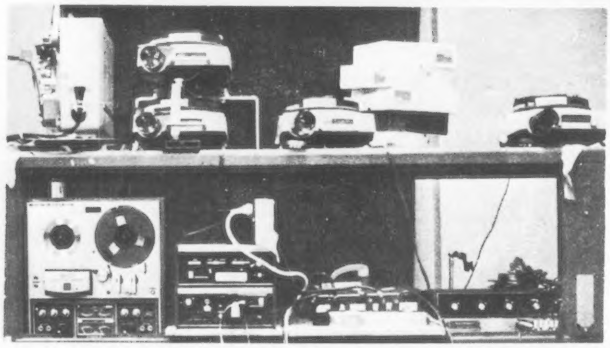


(c) The SINE function:

| A | SIN(A) |
|---|---|
| 0.0 | 0.000 |
| 0.1 | 0.099 |
| 0.2 | 0.198 |
| 0.3 | 0.295 |
| 0.4 | 0.389 |

etc.

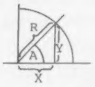




This is a reprint of one of the original Project Solo curriculum modules developed at the University of Pittsburgh. Project Solo was supported in part by the National Science Foundation, and it was directed by Tom Dwyer and Margot Critchfield. The modules were authored by various persons, including project staff, teachers, and students.

It should be kept in mind that Project Solo began in 1969 (which is probably before some of Creative's readers were born). Undoubtedly, many of the modules would be done differently today. There are also surely errors to be found, and neither Creative Computing, the authors, or NSF can warrant the accuracy of the reprints. But as a starting point for your own explorations, they should make a good (albeit slightly ancient) set of shoulders to stand upon. We hope you enjoy the view.

Note: We are using the letters X, Y, A, and R to represent the same quantities as in the module "Circular Functions."

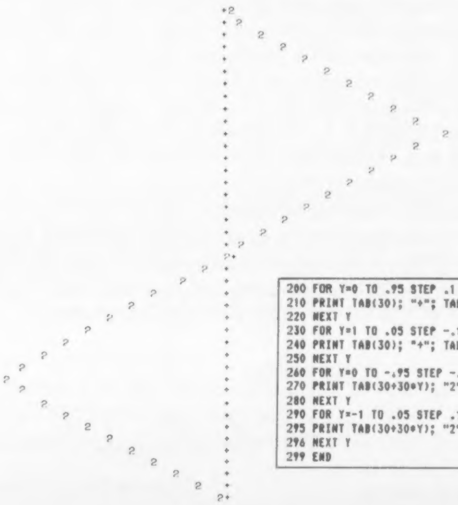


Answer to Problem 1: All of the representations are correct.

Here are three programs which you can try to convince yourself that you can get three different-looking "graphs" of the sine function. The shape of these graphs depends on which variable (X, Y, or A) you decide to increment in equal steps.

After looking over these programs, you may get the feeling that something has been 'put over' on you. Question: Has a little mathematical "hanky-panky" crept into these demonstration programs??? Which one??? (For the answer, read on!!!)

Demonstration Program (a)



```
200 FOR Y=0 TO .95 STEP .1
210 PRINT TAB(30); "+"; TAB(30+30*Y);"2"
220 NEXT Y
230 FOR Y=1 TO .05 STEP -.1
240 PRINT TAB(30); "+"; TAB(30+30*Y);"2"
250 NEXT Y
260 FOR Y=0 TO -.95 STEP -.1
270 PRINT TAB(30+30*Y); "2"; TAB(30); "+"
280 NEXT Y
290 FOR Y=-1 TO .05 STEP .1
295 PRINT TAB(30+30*Y); "2"; TAB(30);"+"
296 NEXT Y
299 END
```

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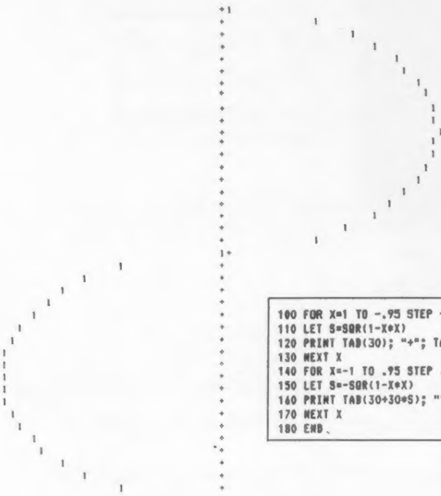
## Trigonometric, con't...

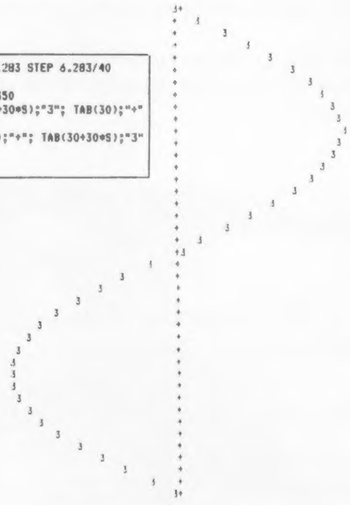
Demonstration Program (b)



```
100 FOR X=1 TO -.95 STEP -.1
110 LET S=SQR(1-X*X)
120 PRINT TAB(30); "+"; TAB(30+30*S); "1"
130 NEXT X
140 FOR X=-1 TO .95 STEP .1
150 LET S=-SQR(1-X*X)
160 PRINT TAB(30+30*S); "1"; TAB(30);"+"
170 NEXT X
180 END
```

Demonstration Program (c)

```
300 FOR A=0 TO 6.283 STEP 6.283/40
310 LET S=SIN(A)
320 IF S>0 THEN 350
330 PRINT TAB(30+30*S);"3"; TAB(30);"+"
340 GOTO 360
350 PRINT TAB(30);"+"; TAB(30+30*S);"3"
360 NEXT A
370 END
```



If you haven't spotted the hanky-panky by now, check line 310 above. Assuming computers can only do arithmetic (which is true), an expression like 30 + 30 * S in line 330 makes sense, but it isn't clear that arithmetic is being used in line 310. Where is the arithmetic being done? Answer: SECRETLY! The computer actually goes into a "library" sub-routine at line 310, which tells it what arithmetic operation must be done on the angle A (expressed in radians) in order to calculate SIN(A).

### The Secret Unveiled

The library functions in digital computers used to evaluate complicated functions almost always employ expertly designed polynomials as approximations to these functions. These approximations can be made quite accurate, using techniques originated by the Russian mathematician Tchebychev (also spelled Chebyshev), and put into useful form by Hastings.1

Here is one of the approximations given by Hastings:

(Hastings Sheet 14)

Function: $\sin\left(\frac{\pi}{2}X\right)$

Range: $-1 \le X \le 1$

Approximation: $\sin\left(\frac{\pi}{2}X\right) \approx C_1X + C_3X^3 + C_5X^5$

where $C_1 = 1.5706268, C_3 = -.6432292$, and $C_5 = .0727102$.

Before using this approximation, it will be useful to make two changes. First, we will change the range of the independent variable by the substitution:

$Y = (\pi/2) * X$ so that when: $-1 \le X \le 1$

we will have: $-\pi/2 \le Y \le \pi/2$

Note: Both Y and X are **angles**, measured in radians. Don't confuse these variables with the Y and X coordinates used in Problem 1. The variable Y in the rest of this discussion is identical to the variable A shown in Problem 1. cover.

After making this substitution, the Hastings Sheet 14 approximation becomes:

$$\sin(Y) \approx K_1Y + K_3Y^3 + K_5Y^5$$

where $K_1 = (2/\pi) * C_1;\ K_3 = (2^3/\pi^3) * C_3;\ K_5 = (2^5/\pi^5) * C_5$.

The second change we will make is to rearrange the right side of the preceding formula into "nested multiplication" form:

$$\sin(Y) \approx (((K_5 * Y * Y + K_3) * Y) * Y + K_1) * Y$$

The advantage of this form is that it only takes five multiplications, whereas the original polynomial takes nine.

Here is a program which uses this form to calculate sin(Y), and compares it with the library routine (which uses a higher degree approximation—see problem 3).

```
run
Program to compare library SIN function with
Hastings 14.


Radians              Library              Hastings 14
------------------------------------------------------
 -1                  -.841471             -.841534
 -.9                 -.783327             -.783407
 -.8                 -.717356             -.717433
 -.7                 -.644218             -.644278
 -.6                 -.564643             -.564679
 -.5                 -.479425             -.479439
 -.4                 -.389418             -.389413
 -.3                 -.29552              -.295505
 -.2                 -.198669             -.198653
 -.1                 -.0998335            -.0998233
  0                   0                    0
  .1                  .0998334             .0998233
  .2                  .198669              .198653
  .3                  .29552               .295505
  .4                  .389418              .389413
  .5                  .479426              .479439
  .6                  .564643              .564679
  .7                  .644218              .644278
  .8                  .717356              .717433
  .9                  .783327              .783407
  1                   .841471              .841534
Ok
```

# Trigonometric, con't...

```
list
290 PRINT "Program to compare library SIN function with"
295 PRINT "Hastings 14.": PRINT: PRINT
300 LET P=3.14159265#
310 LET P2=P*P
315 LET P3=P*P2
320 LET C1=(1.5706268#*2)/P
330 LET C3=(-.643229*8)/P3
340 LET C5=(.0727102*32)/(P2*P3)
350 PRINT "Radians";TAB(20);"Library";TAB(40);"Hastings 14"
355 PRINT "-----------------------------------------------------"
360 FOR Y=-1 TO 1 STEP .1
365 Y=INT(10*Y+.5)/10               'correct roundoff errors
370 S1=(((C5*Y*Y+C3)*Y)*Y+C1)*Y
380 PRINT " ";Y;TAB(20);SIN(Y);TAB(40);S1
390 NEXT Y
400 END
Ok
```

Problem 2. Change the FOR loop in the above program to cover the range for Y = 1 to 3 radians, and see what happens. Also try the range for Y = -1 to -3. If something "blows up," can you modify your program so that **any** value of Y can be used in the Hastings' approximation? (Hint: recall sin(Y) = sin(   -Y) = sin(2   +Y) = sin(3   -Y) = etc.)

Problem 3. Here is the Hastings Sheet 15 approximation which ought to come a lot closer to the values produced by the library function. Modify your program to try it out, again comparing it with the library function.

$$\sin((\pi/2) * X) \approx C_1 * X + C_3 * X^3 + C_5 * X^5 + C_7 * X^7$$

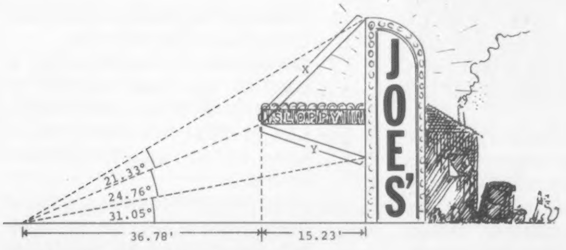
where $C_1 = 1.570794852$ $\quad C_3 = -0.645920978$

$C_5 = 0.079487663$ $\quad C_7 = -0.004362476$

and $-1 \leq X \leq 1$

Problem 4. (Optional) If you find the idea of super-precision interesting, ask your teacher for information on your computer's double precision arithmetic and library functions. One of the best handbooks to use as a standard for "correct" values is "The Handbook of Mathematical Functions, Applied Math Series No. 55" available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 ($6.50). A paperback version published by Dover Co. may be available at book stores for about $5.00.

Problem 5. (Easy) Use the library functions TAN and SQRT to find the lengths of the guy-wires X and Y shown below. (Use of direct mode as a desk calculator is a good way to solve this problem.)



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[1] A book your library ought to have is Hastings, Cecil, **Approximations for Digital Computers**, Princeton University Press, 1955.

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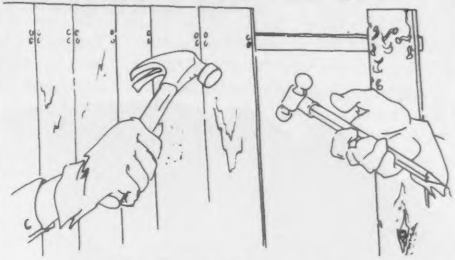

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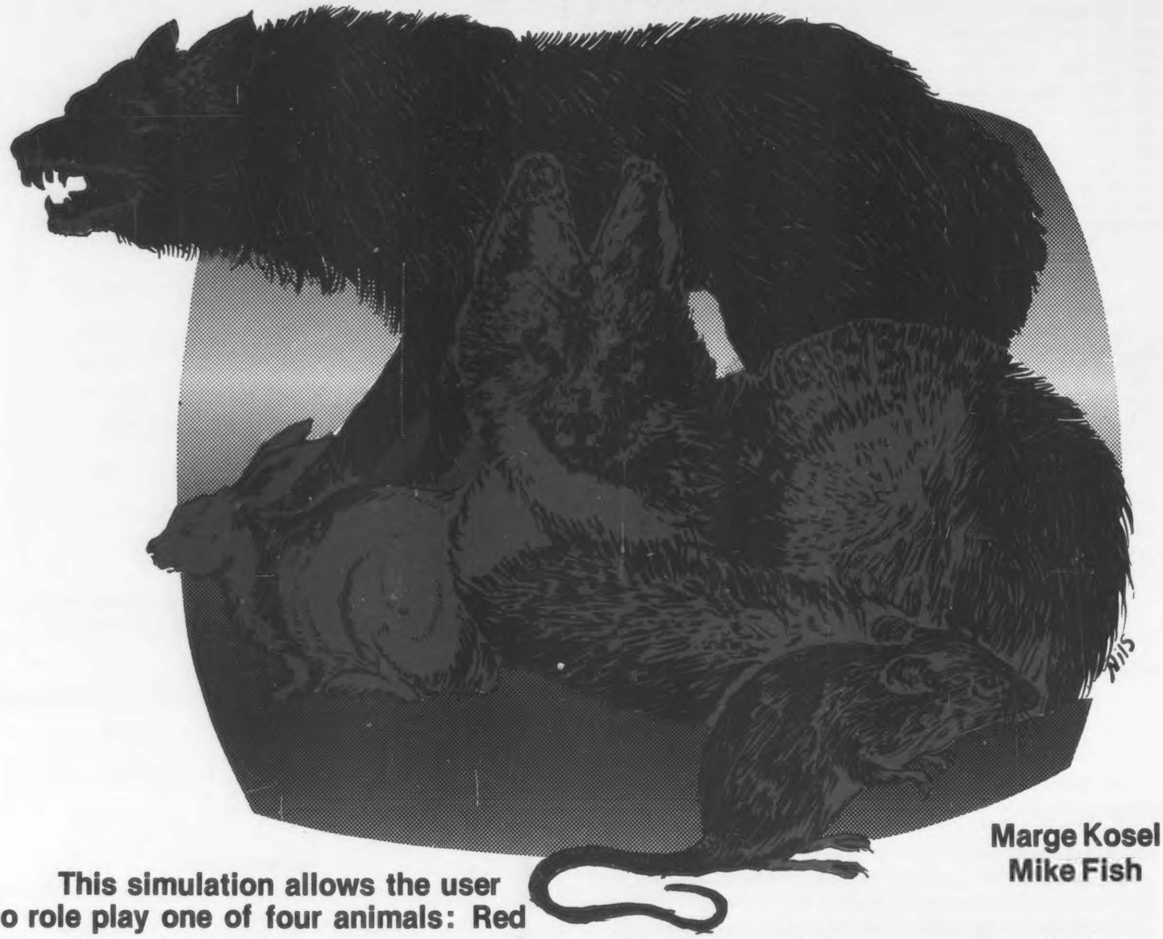
CIRCLE 155 ON READER SERVICE CARD

# An Elementary Simulation – ODELL2



**Marge Kosel**
**Mike Fish**

**This simulation allows the user to role play one of four animals: Red Fox, Snowshoe Rabbit, Mouse, or Wolf, and make decisions regarding their survival as they encounter animals such as the owl, hawk, snake, deer, bear, and racoon, and vegetation such as clover, roots, grass, berries, and bark.**

### Introduction

Many computer simulations have been developed in the State of Minnesota for use by the educational community. The ODELL2 simulation below was derived from a program called ODELL1 created by Ken Witte, a science teacher in Tracy, Minnesota. ODELL1 dealt with food chains among fish in Odell Lake. ODELL1 was used by 10th grade biology students and correlated with a unit from the green version of Houghton-Mifflin biology textbook.

Because of the popularity of the ODELL1 program and because food chains and animal community relationships were covered in lower grade levels, a new simulation called ODELL2 was created. This simulation dealt with the animal relationships.

**About The Authors**

Marge was a former classroom teacher who has been an instructional coordinator for M.E.C.C. the last five years.

Mike will be a senior at Hibbing High School. He has worked for M.E.C.C. developing computer programs and has also done work for independent companies.

Minnesota Educational Computer Consortium, Northeast Instructional Office, Hibbing Community College, Hibbing, MN 55746. (218) 262-3980.

### Instructional Objectives

After the students complete running the program, they should be able to:

1. Describe the characters of each of the four main animals.
2. Described the relationship of each of four main animals to the other animals in the woods.
3. List at least two items which serve as food sources for each animal.
4. If introducted to the concept of herbivores or carnivores, classify the animals as herbivores or carnivores.

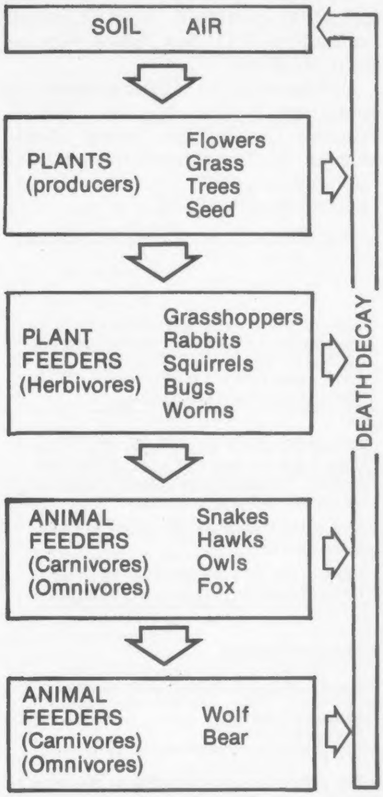
**Program Description**

The use of this program allows the student to role play animals and actively take part in their community relationships. It provides the students an opportunity to make decisions as they would if they were the animals and see the consequences of those decisions. By providing feedback on each student response, the program will teach the student what the correct responses should be. Minnesota animals were chosen for this simulation, so the students could expand their knowledge of the animals in areas around them.

**Background Information**

While all plants require sunlight, soil, water, and minerals to grow, different animals require different kinds of food. Some animals live primarily on plants and others eat meat. Regardless of what an animal eats, all food consumed by animals is ultimately derived from plants.

When viewing the food chain there are basically five groups.

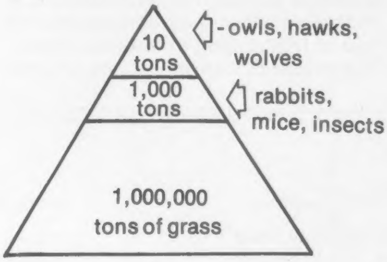


At the bottom of the food chain or cycle are soil, sunlight, and water. Any food cycle is a system of transferring energy. Energy is passed from the sun to the second level - plants. Small animals feed on and derive their energy from the plants. These animals are called herbivores since they feed on herbs and green plants. Carnivorous animals are animals that eat meat instead of just plants, and omnivores are animals that feed on both animals and plants. An animal like a bear is omnivorous. All animals replenish the soil and minerals through decay.

At the top of the food chain, but not an integral part of it, is Man. Man often interferes in the complex cycle provided by nature. As wolves, foxes and animals at the top of the cycle are killed, other parts of the chain may grow out of proportion. For example, if man were to kill the hawks in a certain area, the woods may become overrun with rabbits or mice and this might cause the grass to be completely eaten away and cause erosion or leave little food for other herbivores.

The food cycle has been described as a pyramid of numbers. Animals at the bottom of the pyramid are typically small in size and larger in number. As one moves toward the top of the pyramid, the size of the animals increase while their numbers decrease.

A typical pyramid of numbers for the area is shown in the following diagram:



Looking at the pyramid, you will notice that grass which is at the bottom of the food cycle is most abundant — 1,000,000 tons. About 1,000 tons of plant feeding animals like rabbits, mice, and insects exist while only 10 tons of animals like owls, hawks, and wolves are present. The large animals which occupy the dominant position in the food chain are least in number.

The animals chosen in the simulation are animals common to Minnesota. Below are short abstracts about each of the four main animals.

**Timber Wolf**

The timber wolf is found in the wilder portions of the north woods. Now fairly abundant in Northeastern Minnesota, the wolf prefers to stay in the woods except when the desire for food brings it into open areas. The wolves feed on a variety of animals from mice to deer including rodents, rabbits, and large birds. Wolves usually travel in packs and their keen sense of smell, vision, and hearing make them excellent hunters.

The adult wolf is about 1.5 meters (5 feet) in length, 1.2 meters tall (4 feet) and weighs from 26-36 kilograms (58-79 pounds). The adult male wolf will occasionally reach weights of 72 kilograms (150 pounds). Wolves have very muscular bodies, long legs, curved teeth and slanted eyes. Their fur is gray in color except for the grayish-white underside.

The wolf's cry is a long monotone sound lacking the yapping of the coyote. Living to be about 16 years old, the wolves usually live in dens in rocky areas. They have litters of 4-12 pups which are blind when they are born and are weaned after about 2 months.

**Red Fox**

The red fox can be recognized by its reddish gray color and bushy tail. The feet and legs are black in color with the tip of the tail being white. The fox's body is approximately 1 meter (3 feet) long and he has a .6 meter (2 foot) tail and weighs about 7 kilograms (5 pounds). Although the fox usually sleeps in the open, a den, often borrowed from a woodchuck, serves as a nursery when the litter is young. Four to ten pups are born to each litter. When upset, the fox will cry out with a harsh, penetrating bark.

The fox is omnivorous and eats meat such as rabbits and mice as well as berries, fruits, and nuts. On occation foxes will prey upon domestic animals such as poultry.

Noted for being an intelligent, alert, cunning animal, the fox mainly hunts at night.

**Snowshoe Rabbit**

The snowshoe rabbit's coat changes color seasonally; the summer coat is a dark brown fur and the winter fur changes to snow white. Weighing 1-2 kilograms (2-5 pounds), rabbits are less than ½ meter (1½ feet) long with 13 centimeter (5 inches) hind feet and 7 centimeter (3 inches) ears. Their large feet help them move on the snow. The rabbits have keen eyes to protect them from predatory animals and birds and spend their entire life in a few acres of land.

Rabbits have litters of 2 to 7 furry, open-eyed bunnies and within 2 weeks the little rabbits are eating grasses and summer vegetation.

## ODELL2, con't...

The snowshoe rabbit grooms itself like a cat and takes dust baths to keep clean. In wooded areas, where the rabbits become numerous, they form well established trails in the snow.

In winter, the rabbits eat twigs, buds, and bark, while in the summer green vegetation is its main meal. The rabbit's most common enemies are fox, badger, man and predatory birds such as hawk, eagle, owl and raven. When being chased, the rabbit usually circles the area and thumps warnings of danger.

### Field Mouse

An energetic little creature, the field mouse eats his own weight every 24 hours. Chewing out a network of paths, clipping grass, eating seed, and tramping the surface with its busy feet, the mouse is a builder of one inch highways. On the move day and night, the mouse will die of exhaustion before it is one year old if it has not been caught and eaten by a predator before that time.

Snakes attack the mouse in its burrow, while hawks, owls, crows, herons, and gulls attack from the air. Bullfrogs, trout, and turtles snap it up when it takes a swim while skunks, foxes, and bobcats feed on the mouse in the open. One weasel can wipe out an entire field of mice and even the great brown bear will dig a mouse out of its burrow for food.

Because mice are prey for so many animals, as the pyramid of number shows, mice are plentiful. A litter will consist of 5-9 young with up to 17 litters being born in one year. The young mice are born in a grass nest inside a burrow or in a tuft of weeds. In three weeks they are out on their own and are full grown by three months.

An adult mouse is 13 to 17 centimeters (5½-7 inches) long and weighs 28-70 grams (1-2½ ounces). The male mouse digs a burrow which has side tunnels leading to toilets and escape routes. Some of the tunnels made by mice have been measured to be 150 meters (350 feet) long. The females seldom venture further than 10 meters (20-30 feet) from their birthplace. The mouse, like a squirrel, stores berries, bulbs, roots and seed along its tunnels for the winter.

### Description of the ODELL2 Program and Model

The ODELL2 program allows the user to role play one of the following animals:

Field Mouse
Snowshoe Rabbit
Red Fox
Timber Wolf

Each animal will randomly encounter one of ten situations. If the students survive the ten situations it is assumed that they understand the role of that animal in the food chain. The students can make one of four decisions for their animals when they encounter a situation:

1. Run from the situation.
2. Ignore the situation or problem
3. Attempt to eat the animal or vegetation
4. Chase it out of their territory

The program also keeps track of the animals injuries and the energy it uses and acquires through food. If the animal's energy level gets too low, it will die of starvation. If its injury level is high and it encounters an enemy, its chances of being caught are higher even though students have selected a correct move, such as running from the situation. The model, in order to make the simulation more realistic, is designed so that even if the animal makes the right decision, the outcome is not always what the animal would like. For example, if the wolf attacked the fox, there is a 20% chance that the fox may escape the wolf's attack. The sample chart shows situations the rabbit will encounter and the consequences of the different actions.

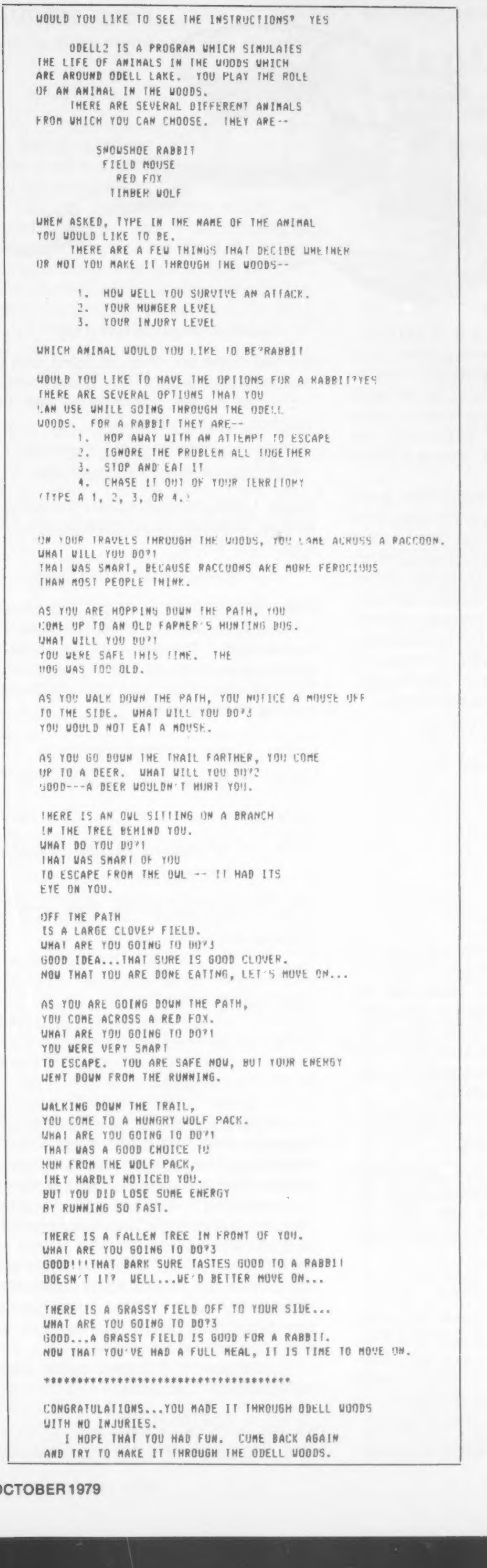
### Program Listing

A listing of ODELL2 is available for $1.00 postpaid from Creative Computing, P.O. Box 789-M, Morristown, NJ 07960.

Information on MECC software is contained in the booklet "MECC Program Distribution Policy" available for $1.00 postpaid from MECC Publications, 2520 Broadway Drive, Lauderdale, MN 55113. ☐

MODEL FOR RABBIT

| SITUATION EN-COUNTERED | ACTION | RESULT |
|---|---|---|
| Fox<br>Wolf | Run | The rabbit has a 80% chance of being successful when it runs. 10% of the time it will be hurt and 10% of the time, even if the rabbit made the right decision, it will be caught. If the rabbit is injured the percentage of time that it will be hurt or caught increases with the severity of the injury. |
| | Ignore | 90% of the time the rabbit will be caught and 10% of the time the wolf or fox will not see it. |
| | Attack | 100% of the time the rabbit will be killed. |
| | Chase | 100% of the time the rabbit will be killed. |
| Clover<br>Tree<br>Grass | Run | Energy will be lost running from these objects. |
| | Ignore | A small amount of energy lost because it passed a chance to eat. |
| | Attack | Energy will be gained from eating and injuries will be healed through the gain of strength and energy. |
| | Chase | Energy will be lost. |
| Owl | Run | The rabbit has a 80% chance to successfully run from the owl. 10% of the time it will be hurt and 10% it will be caught. If the rabbit is injured, the percentage of time it will be caught or hurt increases. |
| | Ignore | 60% of the time it will be caught if it ignores the owl and 40% of the time the owl will not see it or will not attack. |
| | Attack | 100% of the time it will be killed. |
| | Chase | 100% of the time it will be killed. |
| Dog | Run | 75% of the time it will be safe, 15% of the time it will be hurt and 10% of the time caught. The percentage of time it is hurt or caught increases with injuries. |
| | Ignore | 50% of the time it will be caught and 50% of the time safe. |
| | Attack | 100% of the time the rabbit will be killed. |
| | Chase | 100% of the time the rabbit will be killed. |
| Deer<br>Mouse | Run | Energy will be lost. |
| | Ignore | Good response - no energy will be lost. |
| | Attack | Energy will be lost. |
| | Chase | Energy will be lost. |
| Raccoon | Run | The rabbit will escape 100% of the time but lose energy in the run. |
| | Ignore | 80% of the time the rabbit will get killed and 20% of the time it will get away. |
| | Attack | 100% of the time the rabbit will get killed. |
| | Chase | 100% of the time the rabbit will get killed. |



```
WOULD YOU LIKE TO SEE THE INSTRUCTIONS?  YES

     ODELL2 IS A PROGRAM WHICH SIMULATES
THE LIFE OF ANIMALS IN THE WOODS WHICH
ARE AROUND ODELL LAKE.  YOU PLAY THE ROLE
OF AN ANIMAL IN THE WOODS.
     THERE ARE SEVERAL DIFFERENT ANIMALS
FROM WHICH YOU CAN CHOOSE.  THEY ARE--

          SNOWSHOE RABBIT
           FIELD MOUSE
             RED FOX
            TIMBER WOLF

WHEN ASKED, TYPE IN THE NAME OF THE ANIMAL
YOU WOULD LIKE TO BE.
     THERE ARE A FEW THINGS THAT DECIDE WHETHER
OR NOT YOU MAKE IT THROUGH THE WOODS--

      1.  HOW WELL YOU SURVIVE AN ATTACK.
      2.  YOUR HUNGER LEVEL
      3.  YOUR INJURY LEVEL

WHICH ANIMAL WOULD YOU LIKE TO BE?RABBIT

WOULD YOU LIKE TO HAVE THE OPTIONS FOR A RABBIT?YES
THERE ARE SEVERAL OPTIONS THAT YOU
CAN USE WHILE GOING THROUGH THE ODELL
WOODS.  FOR A RABBIT THEY ARE--
      1.  HOP AWAY WITH AN ATTEMPT TO ESCAPE
      2.  IGNORE THE PROBLEM ALL TOGETHER
      3.  STOP AND EAT IT
      4.  CHASE IT OUT OF YOUR TERRITORY
(TYPE A 1, 2, 3, OR 4.)


ON YOUR TRAVELS THROUGH THE WOODS, YOU CAME ACROSS A RACCOON.
WHAT WILL YOU DO?1
THAT WAS SMART, BECAUSE RACCOONS ARE MORE FEROCIOUS
THAN MOST PEOPLE THINK.

AS YOU ARE HOPPING DOWN THE PATH, YOU
COME UP TO AN OLD FARMER'S HUNTING DOG.
WHAT WILL YOU DO?1
YOU WERE SAFE THIS TIME.  THE
DOG WAS TOO OLD.

AS YOU WALK DOWN THE PATH, YOU NOTICE A MOUSE OFF
TO THE SIDE.  WHAT WILL YOU DO?3
YOU WOULD NOT EAT A MOUSE.

AS YOU GO DOWN THE TRAIL FARTHER, YOU COME
UP TO A DEER.  WHAT WILL YOU DO?2
GOOD---A DEER WOULDN'T HURT YOU.

THERE IS AN OWL SITTING ON A BRANCH
IN THE TREE BEHIND YOU.
WHAT DO YOU DO?1
THAT WAS SMART OF YOU
TO ESCAPE FROM THE OWL -- IT HAD ITS
EYE ON YOU.

OFF THE PATH
IS A LARGE CLOVER FIELD.
WHAT ARE YOU GOING TO DO?3
GOOD IDEA...THAT SURE IS GOOD CLOVER.
NOW THAT YOU ARE DONE EATING, LET'S MOVE ON...

AS YOU ARE GOING DOWN THE PATH,
YOU COME ACROSS A RED FOX.
WHAT ARE YOU GOING TO DO?1
YOU WERE VERY SMART
TO ESCAPE.  YOU ARE SAFE NOW, BUT YOUR ENERGY
WENT DOWN FROM THE RUNNING.

WALKING DOWN THE TRAIL,
YOU COME TO A HUNGRY WOLF PACK.
WHAT ARE YOU GOING TO DO?1
THAT WAS A GOOD CHOICE TO
RUN FROM THE WOLF PACK,
THEY HARDLY NOTICED YOU.
BUT YOU DID LOSE SOME ENERGY
BY RUNNING SO FAST.

THERE IS A FALLEN TREE IN FRONT OF YOU.
WHAT ARE YOU GOING TO DO?3
GOOD!!!THAT BARK SURE TASTES GOOD TO A RABBIT
DOESN'T IT?  WELL...WE'D BETTER MOVE ON...

THERE IS A GRASSY FIELD OFF TO YOUR SIDE...
WHAT ARE YOU GOING TO DO?3
GOOD...A GRASSY FIELD IS GOOD FOR A RABBIT.
NOW THAT YOU'VE HAD A FULL MEAL, IT IS TIME TO MOVE ON.

**************************************

CONGRATULATIONS...YOU MADE IT THROUGH ODELL WOODS
WITH NO INJURIES.
   I HOPE THAT YOU HAD FUN.  COME BACK AGAIN
AND TRY TO MAKE IT THROUGH THE ODELL WOODS.
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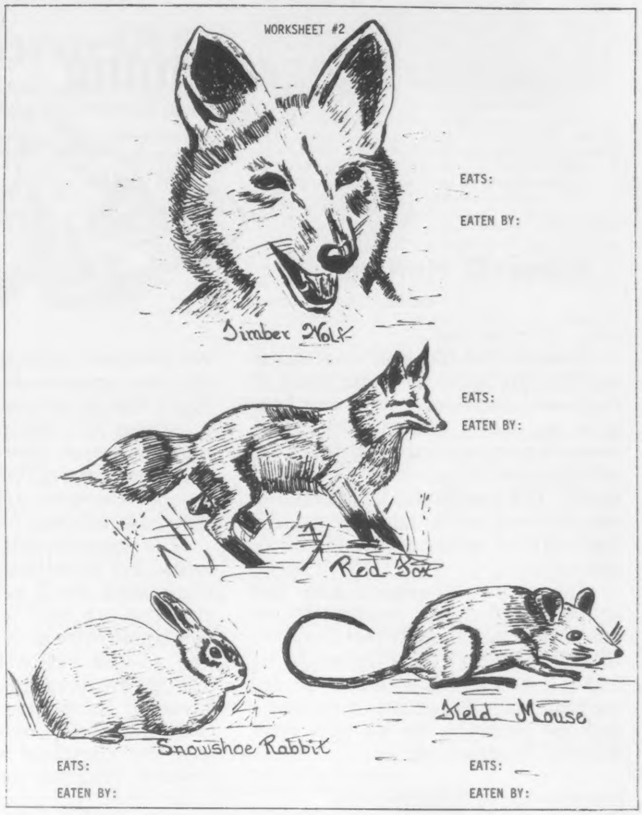

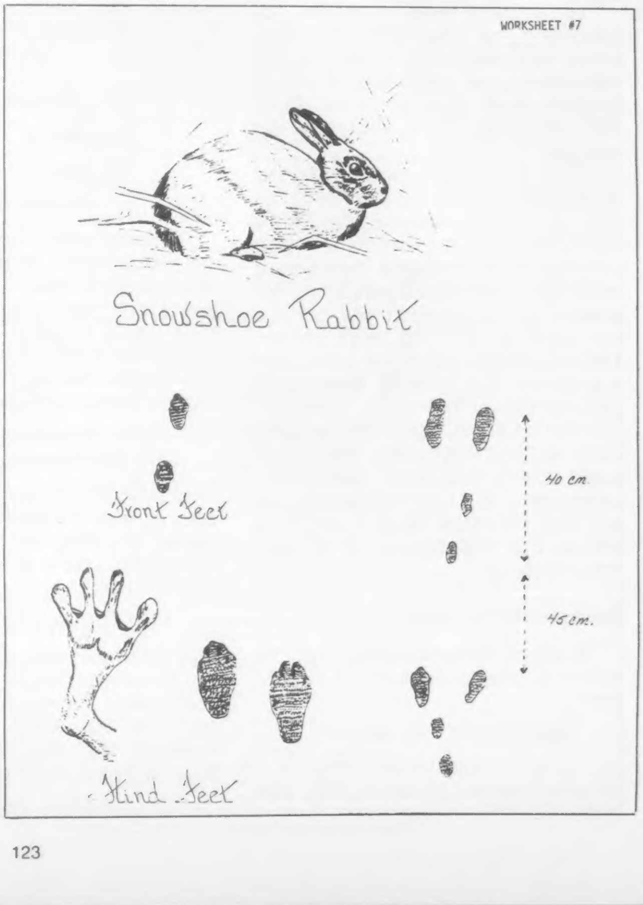

# Blunder Programming

## Robert G. Hoffman

I have a TRS-80 Level II computer and it is the most fantastic piece of electronic machinery I have ever had. With its use, I finally cracked the heretofore impenetrable barrier of the professional programmer's deepest secret. The method for exposing this secret is so important that I've given it the honored name of Blunder Programming.

The word "blunder" was not chosen lightly. Its implication of movement, and the fact that the word "buss" may also be attached to it, make it eminently suitable for describing many aspects of computers and the industry. So we now have Blunder Programming, too.

### Introduction to Programming

To actually start Blunder Programming, all you need to know about languages are a few BASIC statements, so there should be no problem there. Now, on to the selection of problems to illustrate the method.

All textbooks on programming say to be careful about first defining the problem. Some suggest writing a description of the problem using pencil and paper. Maybe they have a point for some problems, but for present purposes such drudgery is too much trouble, so don't bother. Take any problem and just jump right in and start programming. Put on your hat that carries the label, "Director, Computer Center," and start banging away on your keyboard. Pencil and paper aren't forbidden, use them whenever you like. Consider the problem I tackled when I began to realize the importance of Blunder Programming.

### Example of a Problem

In school everyone learns that the area of a circle is given by the expression:

Area = $\pi$r2 or $\pi$ = Area/r2

We were also told that $\pi$ = 3.14159—, with the dashes indicating additional digits that go on indefinitely. Somebody also told me that $\pi$ is called a transcendental number, and such numbers cannot be expressed as rational fractions; a/b, where a and b are whole numbers.

The above is what everybody says is true, but what if they are wrong, and there really are 2 numbers a and b such that a/b = $\pi$? With possibilities of a Noble Prize or at least an invitation to the White House dancing through my head, off I rushed to the keyboard. Banging on the keyboard at first produced no results...I forgot to turn the computer on. Eventually, however, Program 1 was produced.

```
100 FOR I = 1 TO 100
110 FOR J = 1 TO 100
120      A = J/I
130      PRINT A,
140 NEXT J
150 NEXT I
```

Program 1.

Anyone who is foolish enough to put this program on his computer will quickly learn that: 1.) There are an awful lot of fractions, and 2.) Most of them have nothing to do with the problem at hand. So what to do? I will now reveal the first important principle of Blunder Programming:

(1) TRY TO MAKE IT WORK (Even though it's useless)

This principle arises from taking the path of least trouble and thought. In terms of Program 1, all that is required to use it is to replace statement 110 by:

110 FOR J = I TO 100

This gets rid of a lot of unwanted junk, but like many things in Blunder Programming, the results are still useless. At this point, I could have invoked the second principle in Blunder Programming, which is:

(2) TO HELL WITH IT (I wasn't really interested anyway).

If I had done so, then at least one of my problems would have been solved. I did not do so, and had to use the third principle, which is:

(3) TRY TO FIGURE OUT WHAT YOU WANT (If you can't, use 2).

Since I had exhausted all the possibilities of Program 1, I took pencil and paper and wrote:

$\pi$ is close to 10/3 = 3.333---.

Hah! Now maybe I am getting somewhere. All I have to do is increase the numerator if the result is too small; otherwise I increase the denominator. Further banging on the keyboard produced Program 2.

```
100      INPUT "NUMERATOR"; N
110      INPUT "DENOMINATOR"; D
120 R=N/D
130      IF R>3.14159 AND R<3.14160
         PRINT N,D,R
140      IF R>3.14159 THEN GOTO 170
150 N=N+1
160      GOTO 120
170 D=D+1
180      GOTO 120
```

Program 2.

Program 2 works well, but it produced a new crop of problems. After watching the screen for awhile, it seems like all rational functions are estimates of $\pi$. Instead of having too few estimates, now I have too many. It is also rather slow. After all, there are an infinite number of numerators and denominators, which fortunately provide only an infinite number of combinations, but that is still an awful lot of combinations.

Let's see, if I take a more exact estimate for $\pi$, such as:

$\pi$ = 3.14159 26535,

and I change the limits and print

---

Robert G. Hoffman, 315 NW 109 Ave., #203, Miami, FL 33172.

## Blunder, con't...

criteria statements, as well as adding:

```
90 DEFDBL N,D,R
```

so as to have double precision, I can get better answers. I do so, but in spite of all my efforts, the results are still not satisfactory.

Part of the problem might be speed. So I wonder if an assembly language program will help. It should be about 300 times faster than BASIC. I don't know anything about assembly language programming, but maybe I could learn. In the meantime, there are other transcendental numbers I could try, such as:

e = 2,71828---.

In fact, somebody told me that there are more transcendental numbers than there are rational fractions. Wow! What possibilities they provide! All of this leads to the third principle of Blunder Programming:

> (4) IF YOU DON'T LIKE THE PROBLEM, CHANGE IT.

This is actually a corollary of (1), but it's best to bring it out in the open.

By this time, perhaps the secret that professionals have been keeping to themselves has been revealed. In case anyone has missed it, it is stated below:

(Programming is fun, but keep the fun secret).

Small type is used above to emphasize the secrecy caution, which should be noted carefully.

Have you ever noticed how so many people resent simple pleasures for anyone? "Do something practical," they say, like listening to and emulating them. Or they may say, "If you must have pleasure, take a vacation, buy a speedboat, or a bigger computer." In other words, simple, harmless pleasures (unless the critic likes them too) are forbidden.

So if you do master the secret of Blunder Programming, keep it to yourself. If anyone asks you what you are doing, invent a plausible story to assuage his suspicions. He probably won't like your answer, but he won't know what else to say; hence he is likely to leave you alone.

In closing, there is one note of caution about Blunder Programming that should be borne in mind: No matter what problems you tackle, and no matter what you do with them, you will not only have fun, but you will learn more about computers, programming and about the problems themselves. All of this is inevitable. So why not give it a try - all by yourself. ☐

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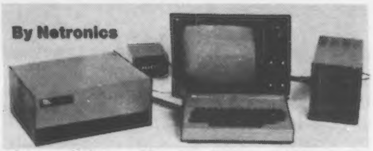
**PC Board:** glass epoxy, plated through holes with solder mask • **I/O:** provisions for 25-pin (DB25) connector for terminal serial I/O, which can also support a paper tape reader ...provision for 24-pin DIP socket for hex keyboard/display...cassette tape recorder input...cassette tape recorder output...cassette tape control output...speaker output... LED output indicator on SOD (serial output) line...printer interface (less drivers)...total of four 8-bit plus one 6-bit I/O ports • **Crystal Frequency:** 6.144 MHz • **Contrc' Switches:** reset and user (RST 7.5) interrupt...additional provisions for RST 5.5, 6.5 and TRAP interrupts onboard • **Counter/Timer:** programmable, 14-bit binary • **System RAM:** 256 bytes located at F800, ideal for smaller systems and for use as an isolated stack area in expanded systems...RAM expandable to 64k via S-100 bus or 4K on motherboard.

**System Monitor (Terminal Version):** 2k bytes of deluxe system monitor ROM located at F000 leaving 0000 free for user RAM/ROM. Features include tape load with labeling ...tape dump with labeling...examine/change contents of memory ...insert data...warm start...examine and change all registers...single step with register display at each break point, a debugging/training feature...go to execution address... move blocks of memory from one location to another...fill blocks of memory with a constant...display blocks of memory ...automatic baud rate selection...variable display line length control (1-255 characters/line)...channelized I/O monitor routine with 8-bit parallel output for high speed printer... serial console in and console out channel so that monitor can communicate with I/O ports.

**System Monitor (Hex Version):** Tape load with labeling... tape dump with labeling...examine/change contents of memory...insert data...warm start...examine and change all



registers...single step with register display at each break point ...go to execution address. Level "A" in the *Hex Version* makes a perfect controller for industrial applications and can be programmed using the Netronics Hex Keypad/Display.

*Hex Keypad/Display.*

**Hex Keypad/Display Specifications**

Calculator type keypad with 24 system defined and 16 user defined keys. 6 digit calculator type display which displays full address plus data as well as register and status information.

**Level "B" Specifications**

Level "B" provides the S-100 signals plus buffers/drivers to support up to six S-100 bus boards and includes: address decoding for onboard 4k RAM expansion select-able in 4k blocks...address decoding for onboard 8k EPROM expansion selectable in 8k blocks...address and data bus drivers for onboard expansion...wait state generator (jumper selectable), to allow the use of slower memories...two separate 5 volt regulators.

*Explorer/85 with Level "C" card cage.*

**Level "C" Specifications**

Level "C" expands Explorer's motherboard with a card cage, allowing you to plug up to six S-100 cards directly into the motherboard. Both cage and cards are neatly contained inside Explorer's deluxe steel cabinet. Level "C" includes a sheet metal superstructure, a 5-card gold plated S-100 extension PC board which plugs into the motherboard. Just add required number of S-100 connectors

**Level "D" Specifications**

Level "D" provides 4k or RAM, power supply regulation, filtering decoupling components and sockets to expand your Explorer/85 memory to 4k (plus the original 256 bytes located in the 8155A). The static RAM can be located anywhere from 0000 to EFFF in 4k blocks.

**Level "E" Specifications**

Level "E" adds sockets for 8k of EPROM to use the popular Intel 2716 or the TI 2516. It includes all sockets, power supply regulator, heat sink, filtering and decoupling components. Sockets may also be used for soon to be available RAM IC's (allowing for up to 12k of onboard RAM).

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☐ **8k Microsoft BASIC** on cassette tape, **$64.95** postpaid.

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☐ **Deluxe Steel Cabinet** for Explorer/85, **$49.95** plus $3 p&h.

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ELVISH-ENGLISH DICTIONARY
CHRIS CLOUTIER

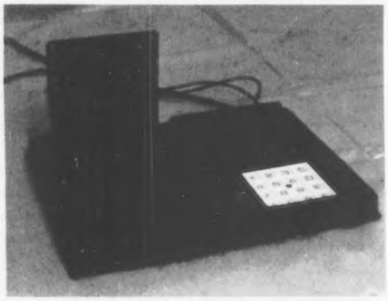
# Two In One: RCA VIP and COSMAC ELF or Teaching Your VIP to Speak Elvish

**Jeff Duntemann**

*Extremely low power consumption, high noise immunity, very good graphics and ease of use are just some of the features which make the RCA VIP one of the more popular single-board computers. By adding the I/O capabilities of the COSMAC Elf the system becomes a useful learning tool for the hobbyist or student.*

Quite a few people have cut their teeth on a minimal, hand-wired, COSMAC Elf system. I can't think of any other widely-known computer design which can be duplicated by a novice in a couple of weekends and still be expected to work. And there is **no** better lesson in computer hardware than to chase down all the bugs and bad wraps in such a system until it sits up and performs as expected. For that alone, the Elf is worth its weight in 2716's.

Another COSMAC-based computer is the RCA VIP (Video Interface Processor) and when RCA announced it, I bought one. Because of the 4K RAM on board and the CHIP-8 interpreter, it was hard to resist. A year's VIP experience has proven to me that there is just no better single-board computer for the beginning computer hobbyist. RCA has aimed their documentation at people who are only marginally familiar with computers, and has done what is still considered heresy elsewhere: to launch the beginner into programming using a minimal interpreter and raw opcodes. Impossible? No. Simple? Just ask someone who owns a VIP.


Elf Adapter Board installed in VIP.

Complete VIP System.

Though both the Elf and the VIP use the CDP1802 CPU, they have practically no I/O in common. The Elf uses toggle switches and a pair of hexadecimal LED indicators, while everything output from the VIP is thrown onto a TV screen, and all input enters through an elastomer keypad.

This means that Elf programs will not run on a VIP, and vice versa. I had written a good number of programs for my Elf, and wanted to run them on

---

Jeff Duntemann, 1907 Crittenden Rd., #2, Rochester, NY 14623.

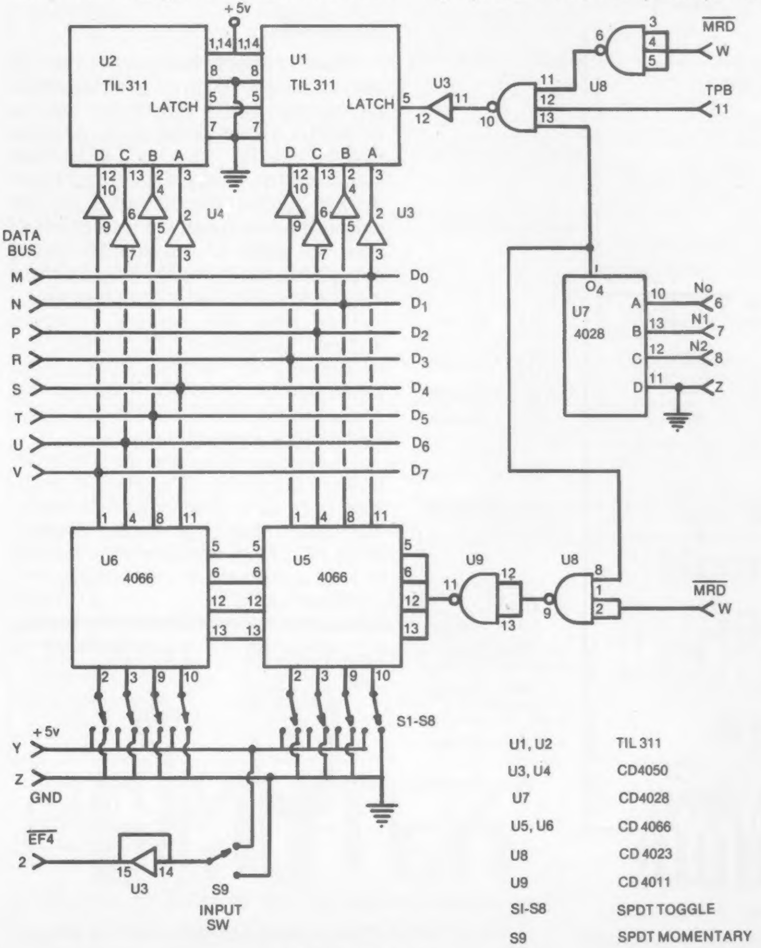
## Two In One, con't...

the VIP without major tinkering. Besides, toggle switches are terrific as initial-condition registers. This means you can set them before beginning a program, say, to provide a speed control in a Morse Code translator. The program can refer to the switches at any time without storing the value in memory, and you can change the value at any time without program assistance.

I also missed the convenience of the INPUT switch. The four flag lines of the VIP cannot be accessed without adding extra hardware. With all that in mind, I designed a single-board adapter which plugs into the VIP expansion interface slot. Initially it had the eight Elf toggle switches, the two-digit hex readout and the input switch. Since that left about half the area of the circuit board empty, I later added a full memory address display. More on that later.

Figure 1 details the circuitry for the Elf I/O portion of the board. The only real change is the addition of a CD4028 3-to-8 line decoder. The Elf used each of the three 1802 N lines as independent data strobe lines. This limits the Elf to only six possible I/O devices. (One input device and one output device for each N line). The N lines actually present a three-bit binary code which can be decoded to provide fourteen separate I/O devices with a strobe signal. (The "000" state of the N lines indicates no I/O operation.) The VIP decodes the three N lines, so the adapter board must do so as well, to avoid the difficult situation of trying to switch two I/O devices to the data bus at the same time. That just doesn't work; hence, the 4028.

The debounce circuit for the INPUT switch is the U3 driver segment which seems to have a dead short between input and output. Yes, and no. The driver input is normally held at +5v by S9. However, when the switch is pressed, the driver output "reaches around" and holds the input at ground, even though the switch contacts may bounce in and out of contact for the next few milliseconds. This prevents the computer (which is very fast and very literal-minded) from thinking that each of those bounces is a separate push on the INPUT switch.



| | |
|---|---|
| U1, U2 | TIL 311 |
| U3, U4 | CD4050 |
| U7 | CD4028 |
| U5, U6 | CD 4066 |
| U8 | CD 4023 |
| U9 | CD 4011 |
| SI-S8 | SPDT TOGGLE |
| S9 | SPDT MOMENTARY |

Figure 1. ELF I/O.

A minor gripe of mine against the VIP is the lack of any means of monitoring memory addresses while a program is running. The operating system displays addresses during program entry or memory examination only. There are times when you flip the RUN switch up and nothing seems to happen. Has the computer stopped completely? Or is it chasing its tail in an endless loop somewhere? Watching memory addresses will usually tell you where the computer is executing instructions, or if it is executing any instructions at all. Having added one to my Elf, I found I couldn't do without it on the VIP. The circuit in Figure 2 will allow you to add one to the Elf-VIP adapter board.

All four hex displays are connected to the memory address bus all the time. They are ganged together as two pairs. The gates in U9 trigger the latch pins of the separate pairs at just the right times to "catch" the correct half of the 1802's memory address. The high-order byte is latched during the TPA pulse and the low-order byte is latched during TPB. Thus you get two different hex bytes from the same eight address pins on the 1802. It's a trick they call memory address multiplexing, and the 1802 is about the only microprocessor that uses it. It was done to free up eight additional pins for the control signals which make the 1802 so easy to use.

Four TIL311 hexadecimal displays may cost a few dollars. I bought mine at a hamfest for $2.50 apiece but you can't always count on such bargains. You can do very well with only U11, U12 and U13 if you never plan on expanding your VIP RAM beyond 4K. U12 and U13 alone can be a big help, especially for short programs which don't go beyond the first 256 bytes of memory. I'd suggest wiring the sockets for all four, since it doesn't hurt to leave a socket empty, and adding a display later is as easy as plugging it in.

The whole works fit very nicely on a Vector 3662-5 wire-wrap card. Mark and drill the holes for the toggle switches before you mount any of the sockets. Tack the wire-wrap sockets to the board with a small drop of airplane glue (you might want to remove them later). Then mount the toggle switches, and finally mount S9. Wrap the logic any way that suits you. CMOS logic, unlike TTL, is very tolerant of ratsnesty wire-wrapping.

The TIL311's draw quite a bit of power, and if you build the full circuit with all six readouts, you may find that they draw enough from the little

# Two In One, con't...

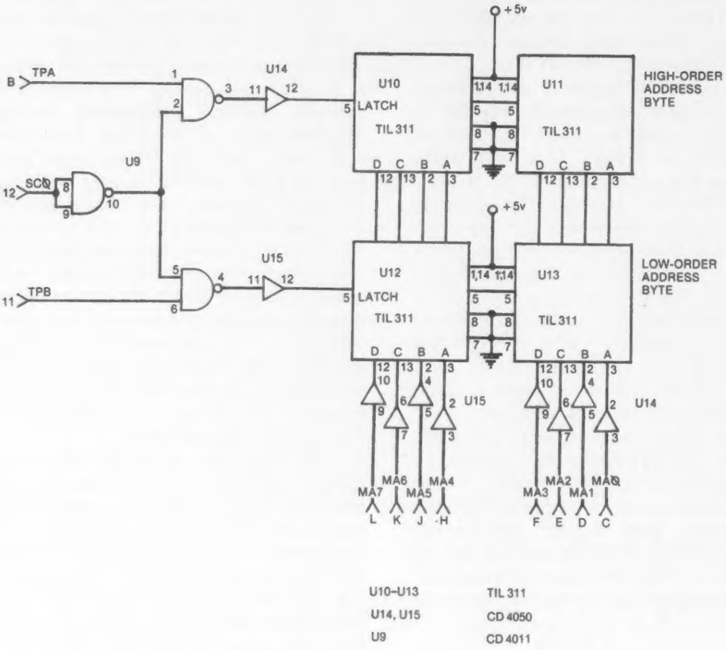

+5v
B
TPA
1
2
3
U14
11
12
U10
LATCH
TIL 311
U11
TIL 311
HIGH-ORDER ADDRESS BYTE
D C B A
U9
12
SC0
8
9
10
+5v
U15
5
4
6
11
TPB
U12
LATCH
TIL 311
U13
TIL 311
LOW-ORDER ADDRESS BYTE
U15
U14
MA7
MA6
MA5
MA4
MA3
MA2
MA1
MA0
L K J H
F E D C
U10–U13 TIL 311
U14, U15 CD 4050
U9 CD 4011

Figure 2. Memory Address Display.

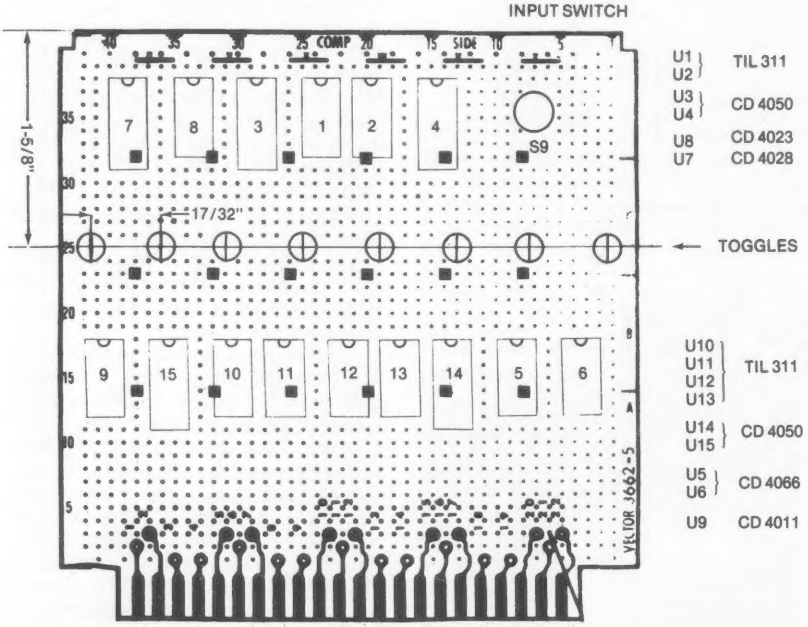

INPUT SWITCH
40
35
30
25 COMP
20
15 SIDE
10
5
1
1-5/8"
17/32"
7
8
3
1
2
4
S9
TOGGLES
9
15
10
11
12
13
14
5
6
VEKTOR 3662-5
U1 U2 TIL 311
U3 U4 CD 4050
U8 CD 4023
U7 CD 4028
U10 U11 U12 U13 TIL 311
U14 U15 CD 4050
U5 U6 CD 4066
U9 CD 4011

Figure 3.

offboard VIP power supply to shut it down from thermal overload. The solution is to install the onboard voltage regulator as described in the VIP manual. The draw is less than an amp and the regulator should supply it with no trouble.

The Elf I/O features are used exactly as they would be on the Elf, except the INPUT switch is no longer used to strobe program bytes from the toggles into memory. (Nobody's going to miss **that** process, I'll bet!) In addition to running Elf software on the VIP, it is possible to write machine-language subroutines which use the Elf I/O features in CHIP-8 programs. For example, my VIP Morse Code package uses the toggles to set code speed, as mentioned earlier. The hexadecimal data displays are useful for showing essential numbers while the VIP video display is busy doing something else. I use mine to count the generations of a Game of Life program. Your imagination will suggest lots of others.

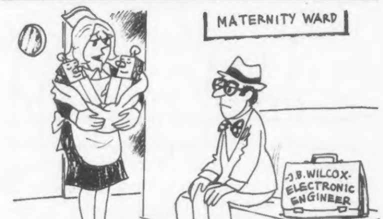
## Conclusion

Several people have written to me asking where to find a momentary pushbutton SPDT switch for use as Elf INPUT switch or S9 on the adapter board. Radio Shack's #275-1549 switch will do nicely. CD4016 IC's will work in place of the CD4066's; in this circuit the two types are interchangeable. All parts of the adapter board except for the hexadecimal displays may be found at Radio Shack as well.

For new VIP owners I would suggest subscribing to VIPER, the exclusively-VIP users' group. It is published by ARESCO, P.O. Box 43, Audubon PA 19407 for $15 annually, and is worth every penny.

A special wire-wrap card with all power runs to the IC sockets is available from O.C. Stafford Electronics, 427 South Benbow Road, Greensboro, NC 27401. Write for their full list of 1802 and amateur radio boards.

Good Luck! ☐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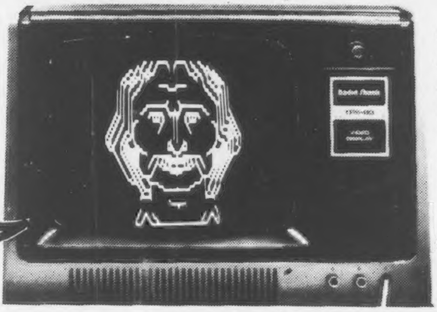
*"The obstetrician wants to talk to you, Mr. Wilcox!"*

# TRS-80 owners LOOK at these Programs!!! (and these prices!!)



*Graphic Drawing Done On The TRS80 Using "The Electric Artist" Program!*

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**INVASION WORG** Time: 2099 Place: Earth's Solar System Mission: As general of earths forces, your job is to stop the Worg invasion and destroy their outposts on mars, venus, saturn, neptune, etc! Earth's Forces: Androids — Space Fighters — Lazer Cannon — Nuetrino Blasters! Worg Forces: Robots — Saucers — Disintegraters — Proton Destroyers! Multi level game lets you advance to more complicated game as you get better!

**STAR WARS** Manuever your space fighter deep into the nucleus of the Death Star! Drop your bomb then escape via the only escape route. This graphics game is really fun! May the force be with you!

**SPACE TARGET** Shoot at enemy ships with your lazer gun. If they eject in a lifeboat vehicle, capture them, or if your cruel, destroy them! Full graphics, real time game!

**SAUCERS** This fast action graphics game, has a time limit! Can you be the commander to win the distinguished cross! Requires split second timing to win! Watch out! The saucers fight back!

**Package One — $12.95**

**CHECKERS 2.1** Finally! A checkers program that will challenge everyone! Expert as well as amateur! Uses 3-ply tree search to find best possible move. Picks randomly between equal moves to assure you of never having identical games. Computer also makes sly remarks about the game!

**POKER FACE** The computer uses psychology as well as logic to try and beat you at poker. Cards are displayed using TRS-80's full graphics. Computer raises, calls, and sometimes even folds! Great practice for your Saturday night poker match!

**PSYCHIC** Tell the computer a little about yourself and he'll predict things about you, you won't believe! A real mind bender! Great amusement for party's.

**TANGLE MANIA** Try and force your opponent into an immobile position. But watch out, their doing the same to you! This graphics game is for 2 people and has been used to end stupid arguments. (And occasionally starts them!)

**WORD SCRAMBLE** This game is for two or more people. One person inputs a word to the computer while the others look away. The computer scrambles word then keeps track of wrong guesses. Can you make less mistakes then your adversary?

**Package Two — $12.95**

**POETRY** This exciting and sometimes funny program lets you choose the subject as well as the mood of the poem you want. You give TRS-80 certain nouns or names, then mood, and he does the rest! TRS-80 will write different poetry about one subject forever if you let him. Has a 1000 word + vocabulary of nouns, verbs, adjectives, adverbs!

**ELECTRIC ARTIST** Written by a working artist and a computer engineer to make drawing on the video screen easier then picking up a pencil! (Less messy too!) Manual: Draw, erase, move as well as, Auto: Draw, erase, move. Uses graphics bit's not bytes. Graphic face in ad done using this ingenius program!

**GALACTIC BATTLE** The Swineus enemy have long range phasers but cannot travel at warp speed! You can, but only have short range phasers! Can you blitzkrieg the enemy without getting destroyed! Full graphics — real time!

**WORD MANIA** Can you guess the computers words using your human intuitive and logical abilities? You'll need to, to beat the computer! He keeps score and gets mad if he loses!

**AIR COMMAND** Real time, graphics Flight Simulater! Land, take-off, get out of a spin! Be careful not to stall! Watch your fuel gauge! Requires a clear headed pilot.

**Package Three — $12.95**

**LIFE** This Z-80 machine language program uses full graphics! Over 100 generations per minute make it truly animated! You make your starting pattern, computer does the rest! Program can be stopped and changes made! Watch it grow!

**REAL TIME LANDER** This full graphics simulater lets you pick what planet, asteroid or moon you wish to land on! The "Live" keyboard gives super response that gives you the feeling of being in command! Has 3 skill levels that make it fun for everyone.

**GREED II** Multi-level game is fun and challenging! Beat the computer at this dice game using your knowledge of odds and luck! Computer keeps track of his winnings and yours. Quick fast action. This game is not easy!

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**CIRCLE 181 ON READER SERVICE CARD**

# CAI: Two Strategies

### George R. Brubaker

Computer assisted instruction is frequently compared with traditional media - the printed page, audio-visual technology, etc. - in terms of cost effectiveness and value. Many of us in academic institutions believe that cost effectiveness of hardware has already been realized. Full utilization of microcomputer based CAI waits only for the development of good programs or program packages.

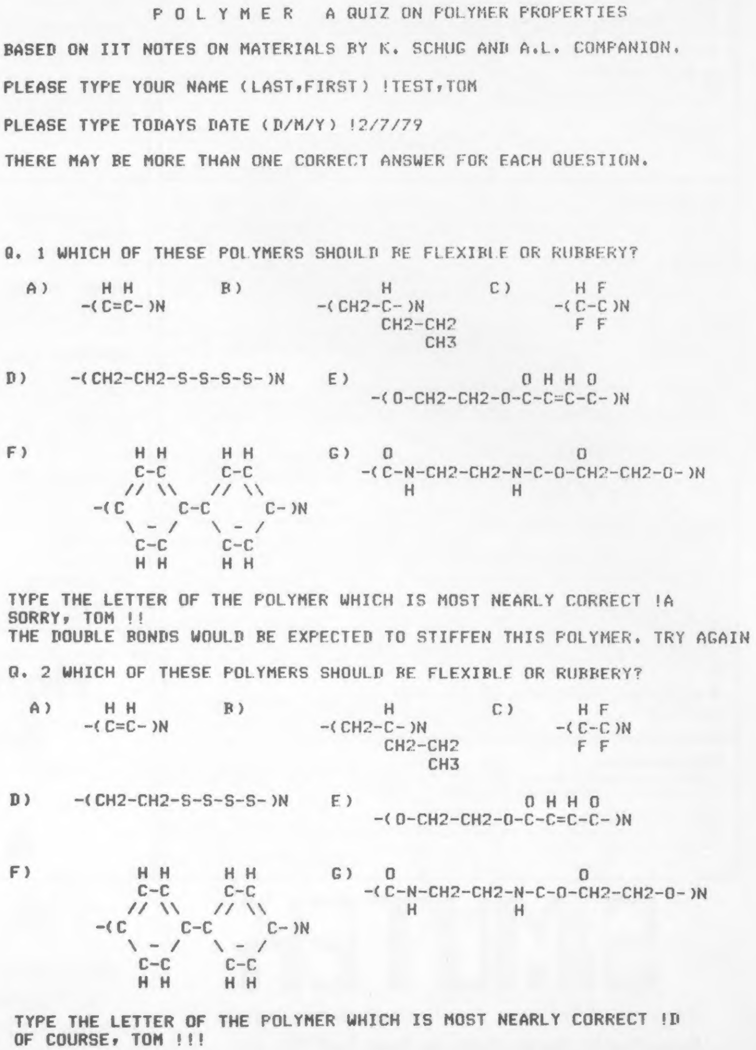
We have established a CAI resource at Illinois Institute of Technology, drawing on programs written by colleagues in secondary schools and colleges throughout the country. We have actively sought drill-and-practice, quiz generating and simulation programs for chemistry; we have added a few laboratory data reduction programs to our library of about 80, written in BASIC and edited to run on the IIT PRIME 400 computer.

It is my purpose to describe features of the IIT program package for chemistry which reflect our approach to striving for optimal instructional value. This article discusses some strategies for returning an appropriate message to correct erroneous student input, in the belief that the principal advantage of CAI, when compared with printed media, for example, is the "instantaneous" return of these corrections.

## Strategy #1

The first strategy was developed to control computer responses to multiple choice questions in which one or more choices might be correct, and each wrong answer can be keyed to a specific message (an error message may serve for one or more wrong answers). In this strategy, the answers contain the keys which control the error messages. In the next example, the questions control the error messages.

One version of this program is called POLYMER (See Listing A). Its purpose is to drill college freshmen on relationships between the properties and molecular structures of polymers. It asks five different questions (currently in a linear sequence, though it could easily randomize the order) based on seven molecular structures (labeled A through G on the output). The program was designed for a video display operating at 1200 baud but without cursor control. Each question begins, therefore, by reproducing the structures on the screen, then posing the question. Student



```
                 P O L Y M E R   A QUIZ ON POLYMER PROPERTIES

BASED ON IIT NOTES ON MATERIALS BY K. SCHUG AND A.L. COMPANION.

PLEASE TYPE YOUR NAME (LAST,FIRST) !TEST,TOM

PLEASE TYPE TODAYS DATE (D/M/Y) !2/7/79

THERE MAY BE MORE THAN ONE CORRECT ANSWER FOR EACH QUESTION.



Q. 1 WHICH OF THESE POLYMERS SHOULD BE FLEXIBLE OR RUBBERY?

  A)     H H         B)             H           C)       H F
       -(C=C-)N                -(CH2-C-)N               -(C-C)N
                                    CH2-CH2                F F
                                        CH3

D)    -(CH2-CH2-S-S-S-S-)N    E)                  O H H O
                                 -(O-CH2-CH2-O-C-C=C-C-)N


F)          H H      H H      G)  O                 O
            C-C      C-C        -(C-N-CH2-CH2-N-C-O-CH2-CH2-O-)N
           // \\    // \\           H         H
       -(C      C-C      C-)N
           \ - /    \ - /
            C-C      C-C
            H H      H H

TYPE THE LETTER OF THE POLYMER WHICH IS MOST NEARLY CORRECT !A
SORRY, TOM !!
THE DOUBLE BONDS WOULD BE EXPECTED TO STIFFEN THIS POLYMER. TRY AGAIN

Q. 2 WHICH OF THESE POLYMERS SHOULD BE FLEXIBLE OR RUBBERY?

  A)     H H         B)             H           C)       H F
       -(C=C-)N                -(CH2-C-)N               -(C-C)N
                                    CH2-CH2                F F
                                        CH3

D)    -(CH2-CH2-S-S-S-S-)N    E)                  O H H O
                                 -(O-CH2-CH2-O-C-C=C-C-)N


F)          H H      H H      G)  O                 O
            C-C      C-C        -(C-N-CH2-CH2-N-C-O-CH2-CH2-O-)N
           // \\    // \\           H         H
       -(C      C-C      C-)N
           \ - /    \ - /
            C-C      C-C
            H H      H H

TYPE THE LETTER OF THE POLYMER WHICH IS MOST NEARLY CORRECT !D
OF COURSE, TOM !!!
```

Figure 1.

---

George R. Brubaker, Dept. of Chemistry, Illinois Institute of Technology, Chicago, IL 60616.

## Strategies, con't...

input is a letter, A through G. The program sets up an answer array in statements 720 thru 770. The program then compares user input with the answer array in statements 780 thru 910. The index, I, is retained to control the error messages (see statements 920 to 1080).

The key B(I) sends all correct answers to statement 930. Thus, if answers "A" and "E" are correct, B(1) = 1, B(5) = 1; if answer "C" implies double bonds, for example, B(3) will direct the program to line 950, and if answer "D" implies hydrogen bonding, B(4) directs the program to line 1040, etc. A sample dialogue is shown in Figure 1. You should be able to think of examples from other disciplines and/or at other achievement levels, which can be handled effectively, using a variation of this strategy.

### Strategy #2

The second example is a very compact program to provide drill and practice on ionization energies of atoms and ions as a function of three parameters. The program (shown in Listing B) selects a pair of atoms or ions for comparison, and brings in three keys which control error messages. The data and keys are READ in (at statement 480) from DATA statements 1110 thru 1140. The first question, statements 520 to 590, is typical of the form in which all questions are posed.

The sum of the keys establishes whether A$ or B$ is the correct answer. Line 630 directs the program to the "backpatting" subroutine and line 600 begins the error treatment. It reflects my personal tendency to use each line as much as possible.

A sample run is shown in Figure 2 and, again, you should be able to think of examples from other disciplines or at other levels where two concepts or objects are to be compared and the differences or similarities can be presented to reinforce the experience posed by the computer. This one has been thoroughly classroom tested at IIT, and it really works!!

### Conclusion

While it's true that there are more convenient languages for CAI than BASIC, it is also true that BASIC is the **lingua franca** of the microcomputer industry, and I hope that those of you who plan to implement CAI on a microcomputer system can use some of these hints. ☐

```
THIS PROGRAM COMPARES IONIZATION ENERGIES OF SOME ATOMS AND IONS.

YOU WILL NEED A PERIODIC TABLE AND YOU WILL NEED TO BE ABLE TO
WRITE ELECTRONIC CONFIGURATIONS.  YOU MIGHT WANT TO TRY PROGRAM
"SPDF" BEFORE BEGINNING.

PLEASE TYPE YOUR NAME (LAST, FIRST) !TEST,TIM

PLEASE TYPE TODAYS DATE (D/M/Y) !2 /7/79

WHEN TYPING ANSWERS, BE SURE TO TYPE THE FORMULA  E X A C T L Y
AS IT WAS TYPED IN THE QUESTION.

UP, UP, AND  A W A Y ........

WHICH OF THESE DO YOU EXPECT TO HAVE A HIGHER IONIZATION ENERGY
             NA  OR  RB ? !NA

RIGHT YOU ARE!! TIM

WHICH OF THESE DO YOU EXPECT TO HAVE A HIGHER IONIZATION ENERGY
             BE  OR  SR ? !SR
NO, TIM  LETS TRY TO FIGURE OUT WHY.

IS THE CHARGE ON BE
1)GREATER THAN  2) EQUAL TO  3) LESS THAN
THAT OF SR ?   (ANSWER 1, 2, OR 3) !1

NO, TIM THE CHARGE ON BE IS
EQUAL TO THAT OF SR

IS THE LARGEST QUANTUM NUMBER FOR THE OUTERMOST ELECTRON OF BE
1)GREATER THAN  2) EQUAL TO  3) LESS THAN
THAT OF SR ?   (ANSWER 1, 2, OR 3) !2

NO, TIM THE LARGEST QUANTUM NUMBER FOR THE OUTERMOST ELECTRON OF BE IS
GREATER THAN THAT OF SR

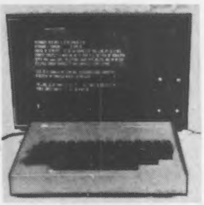
IS THE ELECTRONEGATIVITY OF BE
1)GREATER THAN  2) EQUAL TO  3) LESS THAN
THAT OF SR ?   (ANSWER 1, 2, OR 3) !1


RIGHT YOU ARE!! TIM
```

Figure 2.

**By Netronics**

**ASCII/BAUDOT, STAND ALONE**



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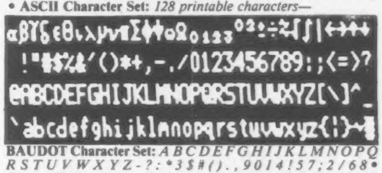
When connected to a computer, the computer must echo the character received. This data is received by the VID which processes the information, converting to data to video suitable to be displayed on a TV set (using an RF modulator) or on a video monitor. The VID generates the cursor, horizontal and vertical sync pulses and performs the housekeeping relative to which character and where it is to be displayed on the screen.

**Video Output:** *1.5 P/P into 75 ohm (EIA RS-170)* • **Baud Rate:** *110 and 300 ASCII* • **Outputs:** *RS232-C or 20 ma. current loop* • **ASCII Character Set:** *128 printable characters—*



!"#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
`abcdefghijklmnopqrstuvwxyz{¦}~

**BAUDOT Character Set:** *A B C D E F G H I J K L M N O P Q R S T U V W X Y Z - ? : * 3 $ # ( ) . , 9 0 1 4 ! 5 7 ; 2 / 6 8* • **Cursor Modes:** *Home, Backspace, Horizontal Tab, Line Feed, Vertical Tab, Carriage Return. Two special cursor sequences are provided for absolute and relative X-Y cursor addressing* • **Cursor Control:** *Erase, End of Line, Erase of Screen, Form Feed, Delete* • **Monitor Operation:** *50 or 60Hz (jumper selectable.*

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**CIRCLE 161 ON READER SERVICE CARD**

Listing A.

```
100 REM  HEADS SUPERSUB  INCLUDES DICTIONARY,HEADER,ALPHAN,CHEER,BOO
110 REM  VERSION 1.0   JULY 6, 1978
120 REM
130 REM  DICTIONARY
140 REM
150 REM  RANDOM NUMBER     RND(0)      RETURNS A RANDOM NUMBER SUCH THAT
160 REM                                0 < RND(0) < 1
170 REM  INTEGER           INT(X)      RETURNS THE INTEGER VALUE OF X
180 REM  SUBSTRING         SUB(A$,1)   RETURNS THE CHARACTER OF STRING A$
190 REM                                AT POSITION 1
200 REM  LENGTH            LEN(A$)     RETURNS THE NUMBER OF CHARACTERS
210 REM                                IN STRING A$
220 REM
230 REM  PROGRAM DEFINITIONS
240 REM
250 REM                      D$    DATE
260 REM                      M$    USER FIRST NAME
270 REM                      N$    USER LAST NAME
280 REM                      Z$    STRING VARIABLE INPUT PARAMETER FOR ALPHAN
290 REM                      O6    NUMERIC VALUE OF STRING VARIABLE FROM ALPHAN
300 REM                      Q     NUMBER OF QUESTIONS ASKED
310 REM                      X     NUMBER OF INCORRECT RESPONSES
320 REM
330 REM  VARIABLES WHICH MAY NOT BE USED
340 REM
350 REM                      I$(0-9)
360 REM                      J$(0-13)
370 REM                      K$(0-9)
380 REM                      O1-O9
390 REM
400 REM
410 PRINT"","P O L Y M E R   A QUIZ ON POLYMER PROPERTIES"
420 PRINT
430 PRINT"BASED ON IIT NOTES ON MATERIALS BY K. SCHUG AND A.I. COMPANION."
440 PRINT
450 PRINT"PLEASE TYPE YOUR NAME (LAST,FIRST)";
460 INPUT N$,M$
470 PRINT
480 PRINT"PLEASE TYPE TODAYS DATE (D/M/Y)";
490 INPUT D$
500 PRINT
510 PRINT"THERE MAY BE MORE THAN ONE CORRECT ANSWER FOR EACH QUESTION."
520 PRINT
530 PRINT
540 PRINT
550 DIM I$(10),J$(13),K$(9)
560 FOR O1=0 TO 9
570 READ I$(O1)
580 NEXT O1
590 DATA "0","1","2","3","4","5","6","7","8","9"
600 FOR O1=0 TO 13
610 READ J$(O1)
620 NEXT O1
630 DATA "VERY GOOD,","CORRECT,","RIGHT,","YES,","GOOD,","EXCELLENT,"
640 DATA "YES, YES, YES,","YOUD BETTER BELIEVE IT,","OF COURSE,"
650 DATA "YOU PASSED THE TEST,","YOU GOT THAT ONE,","FOR SURE,"
660 DATA "YOU GOT IT,","TO BE SURE,"
670 FOR O1=0 TO 9
680 READ K$(O1)
690 NEXT O1
700 DATA "NOPE,","WRONG,","THAT ISNT CORRECT,","SORRY,","NO,","UGH,"
710 DATA "OOPS,","YOU MISSED THAT ONE","I DISAGREE","HISS,"
720 DIM A$(7),B(7),C(7),D(7),E(7),F(7)
730 DATA"A",2,2,2,2,1,"B",1,2,2,2,2,"C",1,2,2,1,2,"D",1,2,1,2,2
740 DATA"E",4,1,2,1,1,"F",3,2,2,2,2,"G",4,1,2,2,1
750 FOR I=1 TO 7
76C READ A$(I),B(I),C(I),D(I),E(I),F(I)
770 NEXT I
```

```
780 Q=0
790 X=0
800 Q=Q+1
810 PRINT
820 PRINT"Q.";Q;"WHICH OF THESE POLYMERS SHOULD BE FLEXIBLE OR RUBBERY?"
830 GOSUB 1720
840 GOSUB 860
850 GOTO 920
860 PRINT"TYPE THE LETTER OF THE POLYMER WHICH IS MOST NEARLY CORRECT";
870 INPUT Z$
880 FOR I=1 TO 7
890 IF A$(I)=Z$ THEN 910
900 NEXT I
910 RETURN
920 ON B(I) GOTO 930,950,1000,1040
930 GOSUB1910
940 GOTO 1090
950 GOSUB1960
960 X=X+1
970 PRINT"THE DOUBLE BONDS WOULD BE EXPECTED TO STIFFEN THIS POLYMER.";
980 PRINT"TRY AGAIN"
990 GOTO 800
1000 GOSUB1960
1010 X=X+1
1020 PRINT"THE AROMATIC RINGS ARE VERY STIFF!! TRY AGAIN."
1030 GOTO 800
1040 GOSUB1960
1050 X=X+1
1060 PRINT"HYDROGEN BONDING WOULD BE EXPECTED TO STIFFEN THIS POLYMER.";
1070 PRINT"TRY AGAIN."
1080 GOTO 800
1090 Q=Q+1
1100 PRINT
1110 PRINT"Q.";Q;"WHICH OF THESE POLYMERS WOULD HAVE STRONG INTERCHAIN"
1120 PRINT"HYDROGEN BONDING?"
1130 GOSUB 1720
1140 GOSUB 860
1150 ON C(I) GOTO 1160,1180
1160 GOSUB1910
1170 GOTO 1230
1180 X=X+1
1190 GOSUB1960
1200 PRINT"POLYMER";A$(I);"HAS NO ELECTRONEGATIVE ATOMS OR POLAR GROUPS"
1210 PRINT"AVAILABLE FOR HYDROGEN BONDING!! TRY AGAIN."
1220 GOTO 1090
1230 Q=Q+1
1240 PRINT
1250 PRINT"Q.";Q;"WHICH OF THESE POLYMERS SHOULD HAVE THE LOWEST THERMAL"
1260 PRINT"STABILITY?"
1270 GOSUB 1720
1280 GOSUB 860
1290 ON D(I) GOTO 1300,1320
1300 GOSUB1910
1310 GOTO 1380
1320 X=X+1
1330 GOSUB1960
1340 PRINT"ALL OF THE BONDS IN POLYMER";A$(I);"HAVE ENERGIES IN THE RANGE"
1350 PRINT"70 TO 140 KCAL/MOLE, SO";A$(I);"SHOULD BE STABLE TO ABOUT 250 C."
1360 PRINT"TRY AGAIN."
1370 GOTO 1230
1380 Q=Q+1
1390 PRINT
1400 PRINT"Q.";Q;"WHICH OF THESE POLYMERS SHOULD HAVE A HIGH GLASS TRANSITION"
1410 PRINT"TEMPERATURE?"
1420 GOSUB 1720
1430 GOSUB 860
1440 ON E(I) GOTO 1450,1470
1450 GOSUB1910
1460 GOTO 1540
```

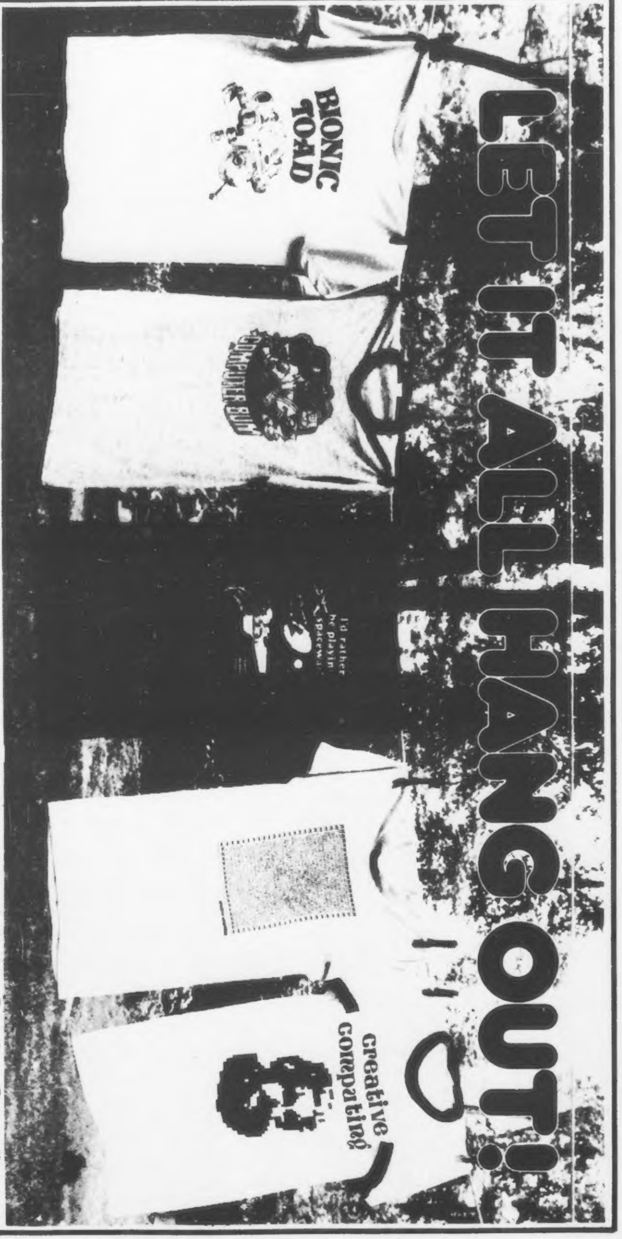
```
1470 X=X+1
1480 GOSUB1960
1490 PRINT"THIS POLYMER SHOULD HAVE LITTLE TENDENCY TO CRYSTALLIZE.  IT HAS"
1500 PRINT"NEITHER GROUPS TO CONTROL THE STEREOCHEMISTRY NOR A GREAT POTENTIAL"
1510 PRINT"FOR HYDROGEN BONDING.  POLYMER";A$(I);"SHOULD HAVE A LOW GLASS"
1520 PRINT"TRANSITION TEMPERATURE.  TRY AGAIN."
1530 GOTO 1380
1540 Q=Q+1
1550 PRINT
1560 PRINT"Q.";Q;"WHICH OF THESE POLYMERS COULD MOST EASILY BE CROSS-LINKED?"
1570 GOSUB 1720
1580 GOSUB 860
1590 ON F(I) GOTO 1600,1620
1600 GOSUB1910
1610 GOTO 1670
1620 X=X+1
1630 GOSUB1960
1640 PRINT"POLYMER";A$(I);"HAS NO REACTIVE FUNCTIONAL GROUPS, SO IT WOULD BE"
1650 PRINT"DIFFICULT TO INTRODUCE CROSS LINKS.  TRY AGAIN."
1660 GOTO 1540
1670 PRINT"CONGRATULATIONS,";M$;", YOU HAVE PASSED THROUGH MY POLYMERIC MAZE!!"
1680 PRINT
1690 PRINT"PROGRAMMED BY G.R. BRUBAKER, IIT, CHICAGO, IL.  COPYRIGHT 1978,"
1700 PRINT"PROGRAMS FOR LEARNING, INC., ALL RIGHTS RESERVED."
1710 GOTO 2020
1720 PRINT
1730 PRINT"  A)     H H         B)              H          C)       H F"
1740 PRINT"       -(C=C-)N                 -(CH2-C-)N              -(C-C)N"
1750 PRINT"                                   CH2-CH2                F F"
1760 PRINT"                                       CH3"
1770 PRINT
1780 PRINT"D)    -(CH2-CH2-S-S-S-S-)N    E)                    O H H O"
1790 PRINT"                                     -(O-CH2-CH2-O-C-C=C-C-)N"
1800 PRINT
1810 PRINT
1820 PRINT"F)            H H      H H       G)   O                 O"
1830 PRINT"              C-C      C-C          -(C-N-CH2-CH2-N-C-O-CH2-CH2-O-)N"
1840 PRINT"             // \\    // \\              H           H"
1850 PRINT"          -(C      C-C      C-)N"
1860 PRINT"             \ - /    \ - /"
1870 PRINT"              C-C      C-C"
1880 PRINT"              H H      H H"
1890 PRINT
1900 RETURN
1910 REM  CHEER  BACK-PATTING SUBROUTINE
1920 REM  M$ IS THE USERS NAME
1930 O1=INT(RND(0)*14)
1940 PRINT J$(O1);M$;"!!!"
1950 RETURN
1960 REM  BOO    WRONG ANSWER SUBROUTINE
1970 REM  M$ IS THE USERS NAME
1980 O1=INT(RND(0)*10)
1990 PRINT K$(O1);M$;"!!"
2000 RETURN
2010 RETURN
2020 REM  SCORES SUBROUTINE    KEEPS RECORDS
2030 REM         Q = NUMBER OF QUESTIONS ASKED
2040 REM         X = NUMBER OF INCORRECT RESPONSES
2050 REM  INSERT PROGRAM NAME IN FOLLOWING LINE  T$="NAME"
2060 T$="POLYMER"
2070 DEFINE FILE #1="SCORES",BIN DA,60
2080 ON END#1 GO TO 2100
2090 POSITION #1 TO 500
2100 WRITE #1,T$,N$,D$,Q,X
2110 PRINT
2120 PRINT "IF YOU WANT TO TRY ANOTHER PROGRAM TYPE = MORE ="
2130 PRINT "IF YOU WANT TO END THIS SESSION, PRESS = BRK = THEN TYPE = LO =";
2140 INPUT C$
2150 IF C$<>"MORE" GOTO 2180
2160 S$="CHEMISTRY"
2170 CHAIN S$
2180 END
```

**Listing B.**

```
100 PRINT
110 DIMZ(50)
120 Q=0
130 PRINT
140 PRINT "THIS PROGRAM COMPARES IONIZATION ENERGIES OF SOME ATOMS AND IONS."
150 PRINT
160 PRINT "YOU WILL NEED A PERIODIC TABLE AND YOU WILL NEED TO BE ABLE TO"
170 PRINT "WRITE ELECTRONIC CONFIGURATIONS.  YOU MIGHT WANT TO TRY PROGRAM"
180 PRINT ""SPDF" BEFORE BEGINNING."
190 PRINT
200 PRINT "PLEASE TYPE YOUR NAME (LAST, FIRST)";
210 INPUT N$,M$
220 PRINT
230 PRINT "PLEASE TYPE TODAYS DATE (D/M/Y)";
240 INPUT D$
250 PRINT
260 PRINT "WHEN TYPING ANSWERS, BE SURE TO TYPE THE FORMULA  E X A C T L Y"
270 PRINT "AS IT WAS TYPED IN THE QUESTION."
280 N1=25
290 FOR K1=1 TO N1
300 Z(K1)=K1
310 NEXT K1
320 FOR K1=1 TO N1
330 K2=N1-K1+1
340 K3=INT(RND(0)*K2)+1
350 Z1=Z(K3)
360 Z(K3)=Z(K2)
370 Z(K2)=Z1
380 NEXT K1
390 PRINT
400 PRINT "UP, UP, AND  A W A Y ........"
410 PRINT
420 Q1=0
430 Q1=Q1+5
440 Q=Q+1
450 IF Q>N1 THEN 1270
460 I=Z(Q)
470 FOR K1=1 TO I
480 READ A$,B$,C,N,X
490 NEXT K1
500 READ A$,B$,C,N,X
510 RESTORE
520 PRINT"WHICH OF THESE DO YOU EXPECT TO HAVE A HIGHER IONIZATION ENERGY"
530 PRINT"                ";A$;" OR ";B$;"?";
540 INPUT C$
550 IF C$=A$ THEN 590
560 IF C$=B$ THEN 590
570 PRINT"ANSWER EITHER";
580 GOTO 530
590 IF (C-N+X)>0 THEN 620
600 P$=A$
610 GOTO 630
620 P$=B$
630 IF C$=P$ THEN 670
640 V=V+1
650 PRINT"NO,";M$;" LETS TRY TO FIGURE OUT WHY."
660 GOTO 690
670 GOSUB 1240
680 GOTO 1060
690 L=0
700 PRINT
710 L=L+1
720 ON L GOTO 730,760,790,930
730 J$="CHARGE ON"
740 P=C
750 GOTO 810
760 J$="LARGEST QUANTUM NUMBER FOR THE OUTERMOST ELECTRON OF"
770 P=N
```

## Strategies, con't...

```
780 GOTO 810
790 J$="ELECTRONEGATIVITY OF"
800 P=X
810 PRINT "IS THE";J$;A$
820 PRINT"1)GREATER THAN  2) EQUAL TO  3) LESS THAN"
830 PRINT"THAT OF";B$;"?   (ANSWER 1, 2, OR 3)";
840 INPUT·Z1
850 PRINT
860 Z2=Z1-2
870 IF P=Z2 THEN 910
880 PRINT"NO,";M$;"THE";J$;A$;"IS"
890 GOSUB 980
900 GOTO 700
910 GOSUB 1240
920 GOTO 700
930 PRINT
940 PRINT"SINCE THE IONIZATION ENERGY INCREASES WITH NET CHARGE AND"
950 PRINT"ELECTRONEGATIVITY, AND DECREASES WITH INCREASING N,"
960 PRINT"THE IONIZATION ENERGY OF";P$;"IS GREATER."
970 GOTO 1060
980 ON P+2 GOTO 990,1010,1030
990 R$="LESS THAN"
1000 GOTO 1040
1010 R$="EQUAL TO"
1020 GOTO 1040
1030 R$="GREATER THAN"
1040 PRINTR$;"THAT OF";B$
1050 RETURN
1060 PRINT
1070 IF Q<Q1 THEN 440
1080 PRINT"DO YOU WANT TO TRY FIVE MORE PROBLEMS (YES OR NO)";
1090 INPUT L$
1100 IF L$="YES" THEN 430
1110 IF L$<>"NO" THEN 1130
1120 GOTO 1290
1130 PRINT"PLEASE ANSWER YES OR NO"
1140 GOTO 1090
1150 DATA"F","F-1",-1,0,-1,"NA+","K+",0,+1,-1,"NA+","NA",-1,+1,-1,"SE","S"
1160 DATA0,-1,1,"S-2","S",1,0,1,"K","CA",0,0,1,"CL-","CL",1,0,1,"K+","K"
1170 DATA-1,+1,1,"SI","P",0,0,1,"NA","RB",0,+1,-1,"CA+","CA+2",1,-1,1
1180 DATA"O-2","S-2",0,+1,-1,"MG","CA",0,+1,-1,"MG+2","CA+2",0,+1,-1
1190 DATA"CL-","F-",0,-1,1,"O","S",0,+1,-1,"GA","SE",0,0,1,"P","SR",0,+1,-1
1200 DATA"NE","KR",0,+1,0,"K","AS",0,0,1,"MG","MG+2",1,-1,1,"S","S-2",-1,0,-1
1210 DATA"N","C",0,0,-1,"CL-","BR-",0,1,-1,"LI","LI+",1,-1,1,"BE","SR",0,-1,-1
1220 DATA"BE","N",0,0,1,"N-3","P-3",0,+1,-1,"N","N-3",-1,0,-1,"AL","AL+3"
1230 DATA1,-1,1
1240 PRINT
1250 PRINT"RIGHT YOU ARE!!";M$;""
1260 RETURN
1270 PRINT"CONGRATULATIONS,";M$;". YOU HAVE TRIED EVERY QUESTION IN MY "
1280 PRINT"FILES."
1290 PRINT
1300 PRINT"PROGRAMMED BY G.R. BRUBAKER, IIT, CHICAGO, IL 60616"
1310 PRINT"COPYRIGHT 1978 PROGRAMS FOR LEARNING, ALL RIGHTS RESERVED."
1320 PRINT
1330 T$="I.P."
1340 ASSIGN "SCORES",1,X
1350 ON END#1 THEN 1370
1360 ADVANCE #1,500,X
1370 WRITE #1,T$,N$,D$,Q,V
1380 PRINT
1390 PRINT "IF YOU WANT TO TRY ANOTHER PROGRAM TYPE = MORE ="
1400 PRINT "IF YOU WANT TO END THIS SESSION, PRESS = BRK = THEN TYPE = LO =";
1410 INPUT C$
1420 IF C$<>"MORE" GOTO 1450
1430 S$="CHEMISTRY"
1440 CHAIN S$
1450 END
```



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**CIRCLE 149 ON READER SERVICE CARD**

# Press Ups

**Ron Behrns**

Press Ups is a simulation of a game by Invicta (who also originated the addictive Mastermind game). It's a two-player game played on a board with pegs (10 red, 10 blue, 29 yellow). One player has red pegs, the other blue. The yellow pegs are neutral and count for neither player.

The game begins with the pegs in up position. One player pushes down a peg of his choice. The other player then pushes down an adjacent peg (of any color) in up position, and play continues in alternating turns. The game ends when all of one player's color pegs have been pushed down, or if there are no legal moves because all the adjacent pegs have already been pushed down. In this case, the player with the most of his own color pegs pressed down is the winner.

The strategy of the game is to guide the direction of play towards pegs of your own color. The player with the advantage can use the corner yellow peg as a trap to halt the game when all the adjacent pegs have been pressed down.

The BASIC simulation of Press Ups is written in SWTPC 8K BASIC Version 2.0 and runs in about 8K of user memory. It can be played by two people (with the computer acting as referee) or by one person with the computer as an opponent. Moves are entered with a simple coordinate system, colors are abbreviated to letters, and pushed-down pegs are printed as asterisks. If you want some human interaction, check out Invicta's original version of Press Ups. □

---

Ron Behrns, 2607 N. Calvert St., Baltimore, MD. 21218.

```
LINES           COMMENTS

320-510     SET UP THE BOARD.  ASSIGNMENT STATEMENTS
            HAVE BEEN USED TO AVOID AN EXCESS OF
            LOOPS.
540-740     DETERMINE THE FIRST MOVE.
750-900     DEFINE SUBSEQUENT MOVES.
1000-1070   PRINTS THE BOARD AFTER THE FIRST
            MOVE AND AFTER EACH TURN.
1090-1180   CHECKS TO SEE IF PLAYER'S MOVE IS
            ADJACENT TO PREVIOUS PLAY.
1190-1310   SCORES THE GAME AND PRINTS THE WINNER.
1360-1450   CHECKS FOR THE END OF THE GAME(NO
            PEGS ADJACENT TO THE LAST ONE PRESSED.)
1500-2160   DETERMINES THE COMPUTER'S MOVE.  A
            GOOD MOVE IS CHOSEN BASED ON THE
            POSITION OF THE ACTION ON THE BOARD.
            IF THE OPTIMUM PEG HAS ALREADY BEEN
            PRESSED, THEN AN ADJACENT MOVE IS
            SELECTED BY THE COMPUTER AT RANDOM.
            THUS IT IS POSSIBLE FOR THE COMPUTER
            TO MAKE A MISTAKE AND THEREBY TO BE
            BEATEN.
2170-2290   PRESSES THE YELLOW CORNER PEG TO
            ESCAPE A TRAP.

THE FOLLOWING GRID IS PROVIDED TO HELP IDENTIFY
THE CO-ORDINATES.

-------------------------------------------
! 1-1 ! 1-2 ! 1-3 ! 1-4 ! 1-5 ! 1-6 ! 1-7 !
-------------------------------------------
! 2-1 ! 2-2 ! 2-3 ! 2-4 ! 2-5 ! 2-6 ! 2-7 !
-------------------------------------------
! 3-1 ! 3-2 ! 3-3 ! 3-4 ! 3-5 ! 3-6 ! 3-7 !
-------------------------------------------
! 4-1 ! 4-2 ! 4-3 ! 4-4 ! 4-5 ! 4-6 ! 4-7 !
-------------------------------------------
! 5-1 ! 5-2 ! 5-3 ! 5-4 ! 5-5 ! 5-6 ! 5-7 !
-------------------------------------------
! 6-1 ! 6-2 ! 6-3 ! 6-4 ! 6-5 ! 6-6 ! 6-7 !
-------------------------------------------
! 7-1 ! 7-2 ! 7-3 ! 7-4 ! 7-5 ! 7-6 ! 7-7 !
-------------------------------------------

HAVE FUN!
```

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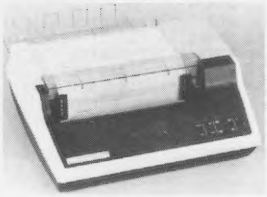

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CIRCLE 154 ON READER SERVICE CARD

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CIRCLE 196 ON READER SERVICE CARD

```
0001 REM ***PRESS UPS***
0002 REM ***RON BEHRNS***
0003 REM ***1979***
0010 LET B=0
0020 LET R=0
0030 PRINT "THIS IS THE GAME OF PRESS UPS"
0035 PRINT "INSTRUCTIONS(Y OR N)";
0040 INPUT I$
0050 IF I$<>"Y" THEN 210
0060 PRINT "TWO MAY PLAY--THE COMPUTER IS YOUR REFEREE"
0070 PRINT "OR YOU MAY PLAY AGAINST THE COMPUTER"
0080 PRINT
0090 PRINT "ONE PLAYER HAS RED PEGS, THE OTHER BLUE:YELLOW IS NEUTRAL"
0100 PRINT "A PEG IS PRESSED DOWN BY INPUTTING CO-ORDINATES OF A GRID"
0110 PRINT "THE PLAYER WHO PRESSES DOWN ALL HIS PEGS FIRST WINS"
0120 PRINT "YOU CAN PRESS DOWN YOUR OPPONENT'S PEGS"
0130 PRINT "IF IT IS IMPOSSIBLE TO PRESS DOWN A PEG NEXT TO THE LAST";
0140 PRINT " ONE PRESSED, THE GAME IS OVER"
0150 PRINT "THE PLAYER WITH THE MOST PEGS PRESSED OF HIS COLOR WINS"
0155 PRINT "END THE GAME AT ANY TIME BY INPUTTING ZERO(0)";
0157 PRINT " FOR THE X CO-ORDINATE"
0160 PRINT
0170 PRINT "DECIDE WHO STARTS(PLAYER A); A YELLOW PEG MUST BE ";
0175 PRINT "PRESSED FIRST"
0180 PRINT "THEN EACH PLAYER IN TURN PRESSES DOWN A PEG(OF ANY COLOR)";
0190 PRINT " NEXT TO THE PREVIOUS ONE PRESSED(IN "
0200 PRINT "ANY DIRECTION--INCLUDING DIAGONALLY)"
0210 PRINT
0220 PRINT "PLAY WITH PARTNER(P) OR COMPUTER(C)";
0230 INPUT R$
0240 IF R$="C" THEN 260
0250 GOTO 290
0260 PRINT "COMPUTER HAS BLUE PEGS--OPPONENT IS PLAYER B"
0270 PRINT "COMPUTER FIRST(Y OR N)";
0280 INPUT R$(1)
0290 PRINT
0300 PRINT "READY...HERE IS THE BOARD"
0310 PRINT :PRINT
0320 FOR X=2 TO 6
0330 FOR Y=2 TO 6
0340 LET P$(X,Y)="Y"
0350 NEXT Y
0360 NEXT X
0370 FOR X=1 TO 8
0380 LET P$(X,8)="*"
0390 NEXT X
0400 LET P$(1,2)="B":P$(1,3)="B":P$(1,4)="B"
0410 KET P$(1,5)="B":P$(1,6)="B"
0420 LET P$(7,2)="B":P$(7,3)="B":P$(7,4)="B"
0430 LET P$(7,5)="B":P$(7,6)="B"
0440 FOR Y=1 TO 8
0450 LET P$(8,Y)="*"
0460 NEXT Y
0470 LET P$(2,1)="R":P$(3,1)="R":P$(4,1)="R"
0480 LET P$(5,1)="R":P$(6,1)="R"
0490 LET P$(2,7)="R":P$(3,7)="R":P$(4,7)="R"
0500 LET P$(5,7)="R":P$(6,7)="R"
0510 LET P$(1,1)="Y":P$(1,7)="Y":P$(7,1)="Y":P$(7,7)="Y"
0520 GOSUB 1000
0530 PRINT
0540 IF R$="C" THEN 660
0550 PRINT "MOVE:PLAYER A"
0560 INPUT X,Y
0570 IF X>7 THEN 560
0580 IF Y>7 THEN 560
0590 IF P$(X,Y)="Y" THEN 610
0600 PRINT "ILLEGAL MOVE...PRESS A YELLOW PEG!!":GOTO 560
0610 LET P$(X,Y)="*"
0620 GOSUB 1000
0630 PRINT
0640 IF R$="C" THEN 1500
0650 GOTO 750
0660 IF R$(1)<>"Y" THEN 740
0670 LET X=INT(3*RND(0)+3)
0680 LET Y=4
0690 PRINT "I MOVE ";X;Y
0700 LET P$(X,Y)="*"
0710 GOSUB 1000
0720 PRINT
0730 GOTO 750
0740 PRINT "MOVE:PLAYER B":GOTO 560
0750 PRINT "MOVE:PLAYER B"
0760 GOSUB 1090
0770 GOSUB 1190
0780 LET P$(X,Y)="*"
0790 GOSUB 1360
0800 IF R$="C" THEN 1500
0810 GOSUB 1000
0820 PRINT
0830 PRINT "MOVE:PLAYER A"
0840 GOSUB 1090
0850 GOSUB 1190
0860 LET P$(X,Y)="*"
0870 GOSUB 1360
0880 GOSUB 1000
0890 PRINT
0900 GOTO 750
0901 REM PRINT BOARD
1000 FOR I=1 TO 7
1010 FOR J=1 TO 7
1020 PRINT P$(I,J);
1030 PRINT "  ";
1040 NEXT J
1050 PRINT CHR$(14)
1060 NEXT I
1070 RETURN
1090 INPUT X(1),Y(1)
1091 REM CHECK ADJACENCY
1100 IF X(1)=0 THEN 1240
1110 IF X(1)>7 THEN 1090
1120 IF Y(1)>7 THEN 1090
1130 IF ABS(X-X(1))>1 THEN 1180
1140 IF ABS(Y-Y(1))>1 THEN 1180
1150 IF P$(X(1),Y(1))="*" THEN 1090
1160 LET X=X(1):Y=Y(1)
1170 RETURN
1180 PRINT "NOT ADJACENT!":GOTO 1090
1190 IF P$(X,Y)="B" THEN B=B+1
1200 IF P$(X,Y)="R" THEN R=R+1
1210 IF B=10 THEN 1270
1220 IF R=10 THEN 1290
1230 RETURN
1240 IF B>R THEN 1270
1250 IF R>B THEN 1290
1260 IF R=B THEN 1310
1270 PRINT "BLUE IS THE WINNER! ";B;" TO ";R
1280 GOTO 1350
1290 PRINT "RED IS THE WINNER! ";R;" TO ";B
1300 GOTO 1350
1310 PRINT "IT'S A TIE!! EACH PLAYER HAS ";B
1350 END
1360 FOR G=X-1 TO X+1
1370 FOR H=Y-1 TO Y+1
1380 IF G=0 THEN NEXT G
1390 IF H=0 THEN NEXT H
1400 IF P$(G,H)<>"*" THEN 1450
1410 NEXT H
1420 NEXT G
1430 PRINT "GAME OVER"
1440 GOTO 1240
1450 RETURN
1451 REM COMPUTER'S MOVE
1500 IF X=1 THEN 1520
1510 IF X<>7 THEN 1630
1520 IF Y>=4 THEN 1560
1530 LET K=X:L=Y+1
1535 IF P$(K,L)="*" THEN L=Y-1
1540 GOTO 1900
1560 IF Y<>4 THEN 1600
1570 LET K=X:L=Y-1
1575 IF P$(K,L)="*" THEN L=Y+1
1580 GOTO 1900
1600 LET K=X:L=Y-1
1605 IF P$(K,L)="*" THEN L=Y+1
1610 GOTO 1900
1630 IF X>=5 THEN 1750
1640 IF Y>=4 THEN 1680
1650 GOSUB 2170
1655 LET K=X-1:L=Y+1
1660 GOTO 1900
1680 IF Y<>4 THEN 1720
1690 LET K=X-1:L=Y
1700 GOTO 1900
1720 GOSUB 2170
1725 LET K=X-1:L=Y-1
1730 GOTO 1900
1750 IF Y>=4 THEN 1790
1760 GOSUB 2170
1765 LET K=X+1:L=Y+1
1770 GOTO 1900
1790 IF Y<>4 THEN 1830
1800 LET K=X+1:L=Y
1810 GOTO 1900
1830 GOSUB 2170
1840 LET K=X+1:L=Y-1
1900 IF P$(K,L)<>"*" THEN 2100
1930 LET K=INT(((X+1)-(X-1)+1)*RND(0)+(X-1))
1940 IF K=0 THEN 1930
1950 LET L=INT(((Y+1)-(Y-1)+1)*RND(0)+(Y-1))
1960 IF L=0 THEN 1950
1970 IF P$(K,L)="*" THEN 1930
2100 LET X=K:Y=L
2110 GOSUB 1190
2120 LET P$(X,Y)="*"
2130 PRINT "I MOVE ";X;Y
2140 GOSUB 1000
2145 PRINT
2150 GOSUB 1360
2160 GOTO 750
2161 REM GRAB CORNER PEG
2170 LET X(2)=X:Y(2)=Y
2175 FOR M=X(2)-1 TO X(2)+1
2180 FOR N=Y(2)-1 TO Y(2)+1
2190 IF M=0 THEN NEXT M
2200 IF N=0 THEN NEXT N
2210 IF M=1 THEN 2240
2220 IF M<>7 THEN 2287
2240 IF N=1 THEN 2270
2250 IF N<>7 THEN 2284
2270 IF P$(M,N)="*" THEN 2290
2275 LET K=M:L=N
2280 GOTO 2100
2284 NEXT N
2287 NEXT M
2290 RETURN
```

```
THIS IS THE GAME OF PRESS UPS
INSTRUCTIONS(Y OR N)? Y

TWO MAY PLAY--THE COMPUTER IS YOUR REFEREE
OR YOU MAY PLAY AGAINST THE COMPUTER

ONE PLAYER HAS RED PEGS, THE OTHER BLUE:YELLOW IS
NEUTRAL
A PEG IS PRESSED DOWN BY INPUTTING CO-ORDINATES
OF A GRID
THE PLAYER WHO PRESSES DOWN ALL HIS PEGS FIRST WINS
YOU CAN PRESS DOWN YOUR OPPONENT'S PEGS
IF IT IS IMPOSSIBLE TO PRESS DOWN A PEG NEXT TO
THE LAST ONE PRESSED, THE GAME IS OVER
THE PLAYER WITH THE MOST PEGS PRESSED OF HIS COLOR
WINS
END THE GAME AT ANY TIME BY INPUTTING ZERO(0) FOR
THE X CO-ORDINATE

DECIDE WHO STARTS(PLAYER A); A YELLOW PEG MUST BE
PRESSED FIRST
THEN EACH PLAYER IN TURN PRESSES DOWN A PEG(OF ANY
COLOR) NEXT TO THE PREVIOUS ONE PRESSED(IN
ANY DIRECTION--INCLUDING DIAGONALLY)

PLAY WITH PARTNER(P) OR COMPUTER(C)? C

COMPUTER HAS BLUE PEGS--OPPONENT IS PLAYER B
COMPUTER FIRST(Y OR N)? Y


READY...HERE IS THE BOARD


Y  B  B  B  B  B  Y
R  Y  Y  Y  Y  Y  R
R  Y  Y  Y  Y  Y  R
R  Y  Y  Y  Y  Y  R
R  Y  Y  Y  Y  Y  R
R  Y  Y  Y  Y  Y  R
Y  B  B  B  B  B  Y

I MOVE 3 4
Y  B  B  B  B  B  Y
R  Y  Y  Y  Y  Y  R
R  Y  Y  *  Y  Y  R
R  Y  Y  Y  Y  Y  R
R  Y  Y  Y  Y  Y  R
R  Y  Y  Y  Y  Y  R
Y  B  B  B  B  B  Y

MOVE:PLAYER B
? 4,33

? 4,2

NOT ADJACENT!
? 4,3

I MOVE 5 3
Y  B  B  B  B  B  Y
R  Y  Y  Y  Y  Y  R
R  Y  Y  *  Y  Y  R
R  Y  *  Y  Y  Y  R
R  Y  *  Y  Y  Y  R
R  Y  Y  Y  Y  Y  R
Y  B  B  B  B  B  Y

MOVE:PLAYER B
? 4,2

I MOVE 3 3
Y  B  B  B  B  B  Y
R  Y  Y  Y  Y  Y  R
R  Y  *  *  Y  Y  R
R  *  *  Y  Y  Y  R
R  Y  *  Y  Y  Y  R
R  Y  Y  Y  Y  Y  R
Y  B  B  B  B  B  Y

MOVE:PLAYER B
? 4,4

I MOVE 5 5
Y  B  B  B  B  B  Y
R  Y  Y  Y  Y  Y  R
R  Y  *  *  Y  Y  R
R  *  *  *  Y  Y  R
R  Y  *  Y  *  Y  R
R  Y  Y  Y  Y  Y  R
Y  B  B  B  B  B  Y

MOVE:PLAYER B
? 4,6

I MOVE 3 5
Y  B  B  B  B  B  Y
R  Y  Y  Y  Y  Y  R
R  Y  *  *  *  Y  R
R  *  *  *  Y  *  R
R  Y  *  Y  *  Y  R
R  Y  Y  Y  Y  Y  R
Y  B  B  B  B  B  Y
```

```
MOVE:PLAYER B
? 4,5

I MOVE 3 6
Y  B  B  B  B  B  Y
R  Y  Y  Y  Y  Y  R
R  Y  *  *  *  *  R
R  *  *  *  *  *  R
R  Y  *  Y  *  Y  R
R  Y  Y  Y  Y  Y  R
Y  B  B  B  B  B  Y

MOVE:PLAYER B
? 4,7

I MOVE 5 7
Y  B  B  B  B  B  Y
R  Y  Y  Y  Y  Y  R
R  Y  *  *  *  *  R
R  *  *  *  *  *  *
R  Y  *  Y  *  Y  *
R  Y  Y  Y  Y  Y  R
Y  B  B  B  B  B  Y

MOVE:PLAYER B
? 6,7

I MOVE 7 7
Y  B  B  B  B  B  Y
R  Y  Y  Y  Y  Y  R
R  Y  *  *  *  *  R
R  *  *  *  *  *  *
R  Y  *  Y  *  Y  *
R  Y  Y  Y  Y  Y  *
Y  B  B  B  B  B  *

MOVE:PLAYER B
? 6,6

I MOVE 7 5
Y  B  B  B  B  B  Y
R  Y  Y  Y  Y  Y  R
R  Y  *  *  *  *  R
R  *  *  *  *  *  *
R  Y  *  Y  *  Y  *
R  Y  Y  Y  Y  *  *
Y  B  B  B  *  B  *

MOVE:PLAYER B
? 6,4

I MOVE 7 4
Y  B  B  B  B  B  Y
R  Y  Y  Y  Y  Y  R
R  Y  *  *  *  *  R
R  *  *  *  *  *  *
R  Y  *  Y  *  Y  *
R  Y  Y  *  Y  *  *
Y  B  B  *  *  B  *

MOVE:PLAYER B
? 6,3

I MOVE 5 2
Y  B  B  B  B  B  Y
R  Y  Y  Y  Y  Y  R
R  Y  *  *  *  *  R
R  *  *  *  *  *  *
R  *  *  Y  *  Y  *
R  Y  *  *  Y  *  *
Y  B  B  *  *  B  *
```

```
MOVE:PLAYER B
? 4,1

I MOVE 3 2
Y  B  B  B  B  B  Y
R  Y  Y  Y  Y  Y  R
R  *  *  *  *  *  R
*  *  *  *  *  *  *
R  *  *  Y  *  Y  *
R  Y  *  *  Y  *  *
Y  B  B  *  *  B  *

MOVE:PLAYER B
? 3,1

I MOVE 2 2
Y  B  B  B  B  B  Y
R  *  Y  Y  Y  Y  R
*  *  *  *  *  *  R
*  *  *  *  *  *  *
R  *  *  Y  *  Y  *
R  Y  *  *  Y  *  *
Y  B  B  *  *  B  *

MOVE:PLAYER B
? 2,1

I MOVE 1 1
*  B  B  B  B  B  Y
*  *  Y  Y  Y  Y  R
*  *  *  *  *  *  R
*  *  *  *  *  *  *
R  *  *  Y  *  Y  *
R  Y  *  *  Y  *  *
Y  B  B  *  *  B  *

MOVE:PLAYER B
? 1,2

I MOVE 1 3
*  *  *  B  B  B  Y
*  *  Y  Y  Y  Y  R
*  *  *  *  *  *  R
*  *  *  *  *  *  *
R  *  *  Y  *  Y  *
R  Y  *  *  Y  *  *
Y  B  B  *  *  B  *
```

```
MOVE:PLAYER B
? 2,4

I MOVE 1 4
*  *  *  *  B  B  Y
*  *  Y  *  Y  Y  R
*  *  *  *  *  *  R
*  *  *  *  *  *  *
R  *  *  Y  *  Y  *
R  Y  *  *  Y  *  *
Y  B  B  *  *  B  *

MOVE:PLAYER B
? 2,5

I MOVE 1 5
*  *  *  *  *  B  Y
*  *  Y  *  *  Y  R
*  *  *  *  *  *  R
*  *  *  *  *  *  *
R  *  *  Y  *  Y  *
R  Y  *  *  Y  *  *
Y  B  B  *  *  B  *

MOVE:PLAYER B
? 2,6

I MOVE 1 7
*  *  *  *  *  B  *
*  *  Y  *  *  *  R
*  *  *  *  *  *  R
*  *  *  *  *  *  *
R  *  *  Y  *  Y  *
R  Y  *  *  Y  *  *
Y  B  B  *  *  B  *

MOVE:PLAYER B
? 2,7

I MOVE 1 6
*  *  *  *  *  *  *
*  *  Y  *  *  *  *
*  *  *  *  *  *  R
*  *  *  *  *  *  *
R  *  *  Y  *  Y  *
R  Y  *  *  Y  *  *
Y  B  B  *  *  B  *

GAME OVER
IT'S A TIE!! EACH PLAYER HAS 7
```

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# USWAR

## Garth Dollahite

USWAR is a civil war game which uses a map of the United States as a playing board. The player controls the side of his choice; the computer controls the opposing side. The game instructions give background information and describe play.

The player makes the initial set up according to his strategy. To play conservatively, one can locate the base and guns far from the front lines. This provides more protection from advancing armies, but leaves that person's front line armies weak, as strength decreases as distance from the base increases. It is not advisable to locate all armies far from the front line, as it would enable the opposing armies to advance freely, capturing land and gaining strength in the process.

Another tactic would be to place everything very close to the front lines. This would increase the field of enemy territory within the guns' ranges and strengthen the front line armies with the base nearby. Remember, however, that they will be vulnerable to advancing armies.

Play continues until a base is either captured or destroyed. In the process, the United States may be disfigured beyond recognition by guns and mines.

---

Garth Dollahite, 1723 S. Adelbert, Stockton, CA.

```
RUN
ARE YOU AN EASTERNER OR WESTERNER? EAST
DO YOU NEED INSTRUCTIONS? YES
A LOBBY, HEADED BY THE DESTROY INTRANATIONAL STUPID
COMPUTERS MOVEMENT OF THE WEST COAST HAS CONVINCED
THE GOVERNMENT TO OUTLAW COMPUTERS.  WE CANNOT ALLOW THIS.
THE EASTERN STATES HAVE DECIDED TO SECEDE FROM
THE UNION.  A BATTLE FRONT HAS DEVELOPED IN THE CENTRAL
STATES.

YOU HAVE BEEN APPOINTED SECRETARY OF WAR.  YOU ARE TO WIN
INDEPENDENCE FOR THE EAST, EVEN IF YOU HAVE TO
DESTROY THE ENTIRE CONTINENT.  WE MUST MAKE THE WORLD SAFE
FOR COMPUTERS BY STOPPING THE D.I.S.C. MOVEMENT.

YOU WILL BE LOCATED AT A BASE.  FROM THERE, YOU ARE TO
CO-ORDINATE ALL ACTIVITIES.  IF YOU CAN DESTROY THE
WEST'S BASE, THEIR EFFORTS WILL BE HALTED AND
COMPUTERS WILL BE SAFE.

HIT RETURN WHEN YOU HAVE READ THIS FAR


THE COUNTRY WILL BE REPRESENTED ON A 47 X 19 MAP:

     !    1    !    2    !    3    !    4    !
                                             :
                                             :::
   UUUUUUUUUUUUUUUUUUUUU:::::::   ::::      :::
  UUUUUUUUUUUUUUUUUUUUUU:::::::::::::     :::::
- UUUUUUUUUUUUUUUUUUUUUU::::::::::::::  ::::::: -
  UUUUUUUUUUUUUUUUUUUUUU:::::::::::::  ::::::
 UUUUUUUUUUUUUUUUUUUUUUU::::::::::::::::::::
 UUUUUUUUUUUUUUUUUUUUUUU::::::::::::::::::::
 UUUUUUUUUUUUUUUUUUUUUUU::::::::::::::::::::
- UUUUUUUUUUUUUUUUUUUUUU::::::::::::::::::::    -
  UUUUUUUUUUUUUUUUUUUUUU::::::::::::::::::::
   UUUUUUUUUUUUUUUUUUUUU:::::::::::::::::::
    UUUUUUUUUUUUUUUUUUUU::::::::::::::::::
     UUUUUUUUUUUUUUUUUUU:::::::::::::::::
-       UUUUUUUUUUUUUUUU::::::::::::::::::      -
           UU  UUUUUUUUU:::::::::::     :::
                   UU UU:::::            :::
                       U::                ::
                        ::
     !    1    !    2    !    3    !    4    !
THE DOTS SHOW YOUR TERRITORY.  YOU WILL NOT BE SHOWN
WHERE ANYTHING IS LOCATED IN THE WEST, BUT ONLY
WHICH LAND IW OCCUPIED.

BOTH SIDES WILL HAVE THE FOLLOWING:

BASE   LOSE IT AND THE WAR IS OVER.  THE CLOSER IT IS TO
       YOUR ARMIES, THE STRONGER THE ARMY.

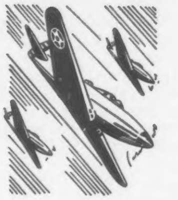
GUNS   THESE ARE MISSILE SITES WHICH CAN LAUNCH MISSLES
       TO DESTROY ANYTHING.  THEY WILL HIT WITHIN ONE UNIT
       PROVIDED IT IS NOT SHOT OUT OF RANGE.  THE MAXIMUM
       RANGE IS BETWEEN 15 AND 25 UNITS.  IF OUT OF RANGE,
       IT MAY LAND ANYWHERE IN THE PATH.  YOU MAY NOT USE
       THE SAME GUN SIGHT TWICE IN A ROW.  ALSO, A GUN SIGHT
       WILL BE INOPERATIVE FOR ONE TURN IF A MISSLE LANDS
       IN AN ADJACENT SPACE.  YOU WILL BE ALLOWED TWO SHOTS
       PER TURN.

ARMIES WILL BE REPRESENTED AS INTEGERS LESS THAN TEN, THE
       HIGHER THE NUMBER, THE STRONGER THE ARMY.  ARMIES SAN
       BE USED AS DEFENSE OR OFFENSE.  THEY CAN PROTECT YOUR
       BASE OR GUNS AGAINST ENEMY ARMIES OR ADVANCE INTO THE
       WESTERN TERRITORY.  ARMIES ARE THE ONLY
       OBJECTS WHICH MAY ADVANCE INTO AND CAPTURE ENEMY
       TERRITORY.  ARMIES WILL ALSO BE REFERED TO AS FORCES.
       YOU WILL BE GIVEN REIFORCEMENTS AFTER WINNING A BATTLE.
       THE MORE LAND YOU CONTROL, THE HIGHER REINFORCEMENT
       STRENGTH.

MINES  ARE USED AS DEFENSE AGAINST ENEMY ARMY ATTACKS.
       THEY WILL DESTROY ANY ATTACKING ARMY.

IDENTIFICATION OF OBJECTS WILL BE BY CO-ORDINATES, COLUMN,
ROW, STARTING FROM THE LOWER LEFT OF THE MAP.
INVALID CO-ORDINATES, SUCH AS 0,0 WILL GIVE AN     1 2 3
UPDATED MAP.  MOVEMENTS CAN BE MADE ONE UNIT IN     8 + 4
ANY DIRECTION.  DIRECTIONS ARE LABLED AT THE        7 6 5
RIGHT.
```

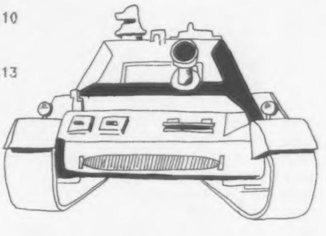
```
THE FOLLOWING IS TO SET UP THE GAME.  ENTER WHERE ON THE MAP
YOU WISH EACH TO BE PLACED.
```



```
LOCATION FOR BASE? 41,14
MINE 1 ? 40,14
MINE 2 ? 40,13
MINE 3 ? 28,13
MINE 4 ? 28,7
GUN 1 ? 30,8
GUN 2 ? 30,13
GUN 3 ? 30,15
GUN 4 ? 28,10
GUN 5 ? 36,6
DISTRIBUTE YOUR FORCES
OF 55.3  FORCE OF 9
                    AT? 24,10
OF 46.3  FORCE OF 8
                    AT? 24,13
OF 38.3  FORCE OF 8
                    AT? 24,8
OF 30.3  FORCE OF 8
                    AT? 24,5
OF 22.3  FORCE OF 8
                    AT? 25,10
OF 14.3  FORCE OF 7
                    AT? 24,9
OF  7.3  FORCE OF 7.3
                    AT? 24,10
MAX. OF .799999 ENTERED
OF  6.5  FORCE OF 6.5
                    AT? 24,12
REINFORCEMENTS
OF  0.3  FORCE OF .3
                    AT? 24,9
OBJECT TO MOVE? 0,0

     !    1    !    2    !    3    !    4    !
                                             :
                                             :::
   WWWWWWWWWWWWWWWWWWWWW:::::::   ::::      :::
  WWWWWWWWWWWWWWWWWWWWWW:::::::::::::     :::::
- WWWWWWWWWWWWWWWWWWWWWW::::::G:::::::  ::::::: -
  WWWWWWWWWWWWWWWWWWWWWW:::::::::::::  :MB:::
 WWWWWWWWWWWWWWWWWWWWWWW8:::M:G:::::::::M:::
 WWWWWWWWWWWWWWWWWWWWWWW6:::::::::::::::::::
 WWWWWWWWWWWWWWWWWWWWWWW::::::::::::::::::::
- WWWWWWWWWWWWWWWWWWWWWW98::G:::::::::::::::    -
  WWWWWWWWWWWWWWWWWWWWWW7:::::::::::::::::::
   WWWWWWWWWWWWWWWWWWWWW8:::::G::::::::::::
    WWWWWWWWWWWWWWWWWWWW::::M:::::::::::::
     WWWWWWWWWWWWWWWWWWW::::::::::::G::::
-       WWWWWWWWWWWWWWWW8:::::::::::::::::      -
           WW  WWWWWWWWW:::::::::::     :::
                   WW WW:::::            :::
                       W::                ::
                        ::
     !    1    !    2    !    3    !    4    !
CO-ORDINATES? 24,10
DIRECTION? 8
YOU WIN THE BATTLE, ENEMY RETREATS
OF 8.66384 HOW MANY TO MOVE? 9
GUN TO FIRE CO-ORDINATES? 30,8
TARGET CO-ORDINATES? 20,10
HIT AT (20, 9)
GUN TO FIRE CO-ORDINATES? 30,13
TARGET CO-ORDINATES? 10,15
HIT AT (10,14)
I TAKE (24,16)
I ATTACK (24, 5) SUCCESSFULLY
RETREAT DIRECTION? 3
ENEMY GUNS DESTROY (35,10) AND (35, 7)
REINFORCEMENTS
OF  2.7  FORCE OF 2
                    AT? 25,6
OF  0.7  FORCE OF .7
                    AT? 23,10
OBJECT TO MOVE? 24,8
DIRECTION? 8
BATTLE LOST
GUN TO FIRE CO-ORDINATES? 30,15
TARGET CO-ORDINATES? 24,16
HIT AT (25,15) THAT WAS YOUR LAND
GUN TO FIRE CO-ORDINATES? 30,15
TARGET CO-ORDINATES? 24,16
HIT AT (24,16) OBJECT DESTROYED
I TAKE (24, 2)
I TAKE (24, 4)
ENEMY GUNS DESTROY (35,13) AND (33, 7)
OBJECT TO MOVE? 0,0
```

```
     !    1    !    2    !    3    !    4    !
                                             :
                                             :::
   WWWWWWWWWWWWWWWWWWWWW:::::::   ::::      :::
  WWWWWWWWWWWWWWWWWWWWWW ::::::::::::     :::::
- WWWWWWWWWWWWWWWWWWWWWW: ::::G:::::::  ::::::: -
  WWWWWWWW WWWWWWWWWWWWW:::::::::::::  :MB:::
 WWWWWWWWWWWWWWWWWWWWWWW7:::M:G:::: ::::M:::
 WWWWWWWWWWWWWWWWWWWWWWW6:::::::::::::::::::
 WWWWWWWWWWWWWWWWWWWWWWW::::::::::::::::::::
- WWWWWWWWWWWWWWWWWWWWW9:7::G:::::: ::::::::    -
  WWWWWWWWWWWWWWWWWW WWW7:::::::::::::::::::
   WWWWWWWWWWWWWWWWWWWWW1:::::G::::::::::::
    WWWWWWWWWWWWWWWWWWWW::::M:::: : ::::::
     WWWWWWWWWWWWWWWWWWW:2::::::::::G::::
-       WWWWWWWWWWWWWWWWW:::::::::::::::::      -
           WW  WWWWWWWWWW::::::::::     :::
                   WW WW:::::            :::
                       WW:                ::
                        ::
     !    1    !    2    !    3    !    4    !
CO-ORDINATES? 23,10
DIRECTION? 8
YOU WIN THE BATTLE, ENEMY RETREATS
OF 8.84613 HOW MANY TO MOVE? 9
GUN TO FIRE CO-ORDINATES? 30,15
THAT GUN IS TEMPORARILY OUT OF ORDER
GUN TO FIRE CO-ORDINATES? 28,10
TARGET CO-ORDINATES? 21,11
HIT AT (21,10) OBJECT DESTROYED
GUN TO FIRE CO-ORDINATES? 28,10
TARGET CO-ORDINATES? 21,9
HIT AT (20,10)
I TAKE (24, 3)
I TAKE (25, 4)
ENEMY GUNS DESTROY (28, 6) AND (28, 5)
REINFORCEMENTS
OF  2.6  FORCE OF 2.6
                    AT? 22,10
MAX. OF 1.15387 ENTERED
OF  1.4  FORCE OF 1.4
                    AT? 24,13
OBJECT TO MOVE? 0,0
```



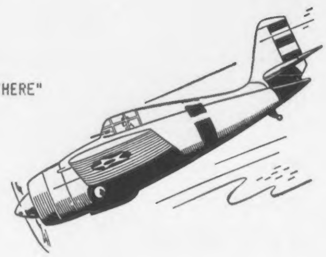
```
LIST
100  REM *** UNITED STATES WAR GAME, EAST VERSUS WEST ***
200  REM *** WRITTEN BY GARTH DOLLAHITE               ***
300  REM ***            FRANKLIN HIGH SCHOOL          ***
400  REM ***            STOCKTON CALIFORNIA           ***
500  REM ***            HP2000 BASIC    MAY 1978      ***
600  REM ***            MICROSOFT VERSION <SN> APRIL 1979
1010  DIM M(47,19),G(33)
1020  FOR I=1 TO 33:  G(I)=1: NEXT I
1030  S$="LANDBASEGUN MINEARMY"
1040  C$="WEEA"
1050  PRINT "ARE YOU AN EASTERNER OR WESTERNER";
1060  INPUT P$
1070  IF LEFT$(P$,2)="WE" THEN P=-1 ELSE P=1
1080  IF P<-1 THEN 1050
1090  FOR I=1 TO 47: FOR J=1 TO 19: M(I,J)=0: NEXT J: NEXT I
1100  C=0
1110  RESTORE 1220
1120  FOR Y=19 TO 1 STEP -1
1130  IF Y<19 THEN 1160
1140  READ A,B
1150  IF A <= C THEN 1210
1160  FOR X=A TO B
1170  M(X,Y)=SGN(X-23.5)*P
1180  NEXT X
1190  C=B
1200  GOTO 1140
1210  NEXT Y
1220  DATA 45,45,45,47,3,30,34,37,44,46,2,36,42,46
1230  DATA 2,37,40,46,2,36,39,44,1,43,1,43,1,43,2,43
1240  DATA 2,43,3,42,4,41,5,40,8,41,11,12,15,34,40,42
1250  DATA 19,20,22,28,41,43,23,25,42,43,24,25,0,0
1260  PRINT "DO YOU NEED INSTRUCTIONS";
1270  INPUT X$
1280  IF LEFT$(X$,1)="Y" THEN 5980
1290  PRINT "LOCATION FOR BASE";
1300  GOSUB 5300
1310  M(A,B)=2
1320  B(3)=A
```

```
1330  B(4)=B
1340  FOR X=1 TO 4
1350  PRINT "MINE"X;
1360  GOSUB 5300
1370  IF A<22 OR A>25 THEN 1400
1380  PRINT "TOO CLOSE TO THE FRONT LINES"
1390  GOTO 1350
1400  M(A,B)=4
1410  NEXT X
1420  FOR X=3 TO 15 STEP 3
```

FINISH THE JOB!

```
1430  PRINT "GUN"X/3;
1440  GOSUB 5300
1450  M(A,B)=3
1460  G(X-1)=A
1470  G(X)=B
1480  NEXT X
1490  F=40+RND(1)*25: T=F
1500  GOSUB 1520
1510  GOTO 1840
1520  PRINT "DISTRIBUTE YOUR FORCES"
1530  IF T<.1 THEN 5090
1540  PRINT USING "OF###.#  FORCE OF ";T-.05;
1550  REM
1560  LINE INPUT X$: S=VAL(X$)
1570  IF S THEN 1600
1580  PRINT
1590  GOTO 5090
1600  IF S>0 THEN 1630
1610  GOSUB 4800
1620  GOTO 1530
1630  IF S <= T THEN 1660
1640  PRINT: PRINT "ONLY"T"LEFT"
1650  GOTO 1540
1660  IF S<10 THEN 1690
1670  PRINT: PRINT "LESS THAN TEN"
1680  GOTO 1530
1690  PRINT TAB(22)"AT";
1700  GOSUB 5300
1710  S=S/10
1720  IF INT(M(A,B))=5 THEN 1760
1730  T=T-S*10
1740  S=S+4
1750  GOTO 1810
1760  IF M(A,B)+S<6 THEN 1790.
1770  S=5.99-M(A,B)
1780  PRINT "MAX. OF"S*10"ENTERED"
1790  T=T-S*10
1800  IF M(A,B)+S>5.98 THEN 1820
1810  S=S+.01
1820  M(A,B)=M(A,B)+S
1830  GOTO 1530
1840  REM COMPUTER CHOOSES POSITIONS
1850  GOSUB 5410
1860  M(A,B)=-2
1870  B(1)=A
1880  B(2)=B
1890  FOR X=17 TO 32 STEP 3
1900  GOSUB 5410
1910  M(A,B)=-3
1920  G(X)=A
1930  G(X+1)=B
1940  GOSUB 5440
```

```
1950  IF X>23 THEN 1970
1960  A=23+.5-P/2-INT(RND(1)*2)*P
1970  IF M(A,B)<>-1 THEN 1940
1980  M(A,B)=-4
1990  NEXT X
2000  FOR X=1 TO F+5
2010  B=INT(RND(1)*17)+1
2020  C=23+.5-P/2
2030  IF M(C,B)<-4 THEN 2060
2040  IF M(C,B)<>-1 THEN 2010
2050  M(C,B)=-5
2060  IF M(C,B)<-5.9 THEN 2010
2070  M(C,B)=M(C,B)-.1
2080  NEXT X
2090  FOR I=1 TO 10:  T(I)=0: NEXT I
2100  REM *** START GAME ***
2110  ON SGN(B(1))+SGN(B(3))*2+1 GOTO 6520,6550,6590
2120  FOR I=1 TO 10: L(I)= 0  : NEXT I
2130  FOR X=1 TO 47
2140  FOR Y=1 TO 19
2150  IF  M(X,Y)=0 THEN 2230
2160  N=(SGN(M(X,Y))+3)/2
2170  L(N)=L(N)+1
2180  IF M(X,Y)<-4 THEN 2210
2190  IF M(X,Y)<5 THEN 2230
2200  M(X,Y)=M(X,Y)-9.9999E-03
2210  IF ABS(M(X,Y))>5.01 THEN 2230
2220  M(X,Y)=SGN(M(X,Y))
2230  NEXT Y
2240  NEXT X
2250  IF T(5) THEN 2290
2260  IF RND(1)>.4 THEN 2330
2270  T=RND(1)
2280  GOTO 2300
2290  T=L(2)/100
2300  PRINT "REINFORCEMENTS"
2310  GOSUB 1530
2320  T(5)=0
2330  PRINT "OBJECT TO MOVE";
2340  GOSUB 5260
```



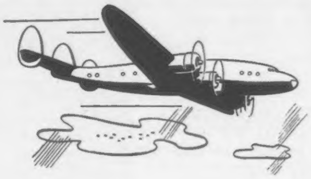
```
2350  A1=A
2360  B1=B
2370  N=M(A,B)
2380  IF N>1 THEN 2430
2390  PRINT "YOU HAVE NOTHING THERE"
2400  GOTO 2330
2410  A=A1
2420  B=B1
2430  GOSUB 5110
2440  IF C=0 THEN 3200
2450  IF  A=0  THEN 2410
2460  M=M(A,B)
2470  IF INT(N)=5 THEN 2620
2480  IF M<>1 THEN 2410
2490  M(A1,B1)=1
2500  M(A,B)=N
2510  IF N=3 THEN 2560
2520  IF N=4 THEN 3200
2530  B(3)=A
2540  B(4)=B
2550  GOTO 3200
2560  FOR K=2 TO 14 STEP 3
2570  IF G(K)=A1 AND G(K+1)=B1 THEN 2590
2580  NEXT K
2590  G(K)=A
2600  G(K+1)=B
2610  GOTO 3200
2620  REM MOVE ARMY
2630  T(3)=A
2640  T(4)=B
2650  IF INT(M)+5>0 THEN ON INT(M)+5 GOTO 3190,3000,3000,3020,2410,3020,
2410,2410,2410,3020
2660  REM ARMY BATTLE
2670  D=SQR((T(3)-A1)^2+(T(4)-B1)^2)/100
2680  IF RND(1)+(N+ABS(M)-10+D)>N-5 THEN 2970
2690  PRINT "YOU WIN THE BATTLE, ENEMY ";
2700  N=(N-5)*(.75+(RND(1)*24)/100)+5:  M(A1,B1)=N
2710  Q=1:  T(5)=0
2720  FOR X=A-1 TO A+1
2730  IF X<1 OR X>47 THEN 2790
2740  FOR Y=B-1 TO B+1
2750  IF Y<1 OR Y>19 OR (A=X AND B=Y) THEN 2780
2760  IF M(X,Y)<>-1 THEN 2780
2770  Q=0
2780  NEXT Y
2790  NEXT X
2800  IF Q THEN 2940
2810  A2=A
2820  B2=B
2830  PRINT "RETREATS"
2840  A=A2
2850  B=B2
2860  C=INT(RND(1)*8)+1
2870  GOSUB 5130
2880  IF  A=0 THEN 2840
2890  IF M(A,B)<>-1 THEN 2840
2900  M(A,B)=(M+5)*RND(1)-5
2910  A=A2
2920  B=B2
2930  GOTO 2950
2940  PRINT "IS DESTROYED"
2950  M(A,B)=1
2960  GOTO 3020
2970  PRINT "BATTLE LOST"
2980  M(A1,B1)=(N-5)*RND(1)+5
2990  GOTO 3200
3000  PRINT "YOU'VE CAPTURED A ";MID$(S$,ABS(M)*4-3,4)
3010  GOSUB 5690
3020  PRINT "OF"(N-5)*10"HOW MANY TO MOVE";
3030  INPUT L
3040  IF L<0 THEN 3020
3050  L=L/10
```

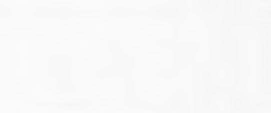
```
3060  IF INT(M)<>5 OR M+L<6 THEN 3090
3070  PRINT "TOO MUCH"
3080  GOTO 3020
3090  IF L<N-5 THEN 3130
3100  L=N-5
3110  M(A1,B1)=1
3120  GOTO 3140
3130  M(A1,B1)=N-L
3140  IF INT(M)<>5 THEN 3170
3150  M(A,B)=M+L
3160  GOTO 3200
3170  M(A,B)=5+L
```

```
3180  GOTO 3200
3190  GOSUB 5920
3200  REM SHOOT GUNS
3210  FOR X=1 TO 31 STEP 3
3220  G(X)=G(X)+1
3230  NEXT X
3240  Y=1
3250  FOR F2=1 TO 2
3260  GOSUB 5630
3270  IF G THEN 3310
3280  IF F2=2 THEN 3690
3290  PRINT "YOU HAVE NO GUNS TO FIRE"
3300  GOTO 3690
3310  PRINT "GUN TO FIRE ";
3320  GOSUB 5250
3330  IF M(A,B)=3 THEN 3360
3340  PRINT "THERE IS NO GUN THERE"
3350  GOTO 3310
3360  FOR Z=1 TO 13 STEP 3
3370  IF G(Z+1)=A AND G(Z+2)=B THEN 3390
3380  NEXT Z
3390  IF G(Z) THEN 3420
3400  PRINT "THAT GUN IS TEMPORARILY OUT OF ORDER"
3410  GOTO 3310
3420  PRINT "TARGET ";
3430  GOSUB 5250
3440  IF SQR((A-G(Z+1))^2+(B-G(Z+2))^2)<RND(1)*11+14 THEN 3490
3450  PRINT "OUT OF RANGE"
3460  R=RND(1)
3470  A=INT(A+(G(Z+1)-A+1)*R+.5)
3480  B=INT(B+(G(Z+2)-B+1)*R+.5)
3490  C=INT(RND(1)*10)
3500  GOSUB 5130
3510  IF A THEN 3540
3520  PRINT "OFF MAP"
3530  GOTO 3650
3540  PRINT "HIT AT";
3550  GOSUB 5480
3560  N=INT(M(A,B))
3570  IF N THEN 3590
3580  PRINT "SPLASH";
3590  IF ABS(N)<2 THEN 3620
3600  PRINT "OBJECT DESTROYED ";
3610  GOSUB 5690
3620  IF N<1 THEN 3640
3630  PRINT "THAT WAS YOUR ";MID$(S$,N*4-3,4);
3640  M(A,B)=0
3650  G(Z)=-1
3660  GOSUB 5510
3670  PRINT
3680  NEXT F2
3690  REM *** COMPUTER´S MOVE ***
3700  IF  T(1)=0 THEN 3880
3710  T=L(1)/100
3720  REM DISTRIBUTE MEN
3730  GOSUB 5810
3740  IF Q THEN 3880
3750  FOR X=3 TO 4
3760  A(X)=T(X)+INT(RND(1)*3)-1
3770  IF A(X)<1 OR A(X)>47 THEN 3760
3780  NEXT X
3790  V=M(A(3),A(4))
3800  IF V<>-1 AND (INT(V)<>-6 OR V<5.89) THEN 3750
3810  IF V=-1 THEN 3840
3820  M(A(3),A(4))=V-.1
3830  GOTO 3850
3840  M(A(3),A(4))=-5.1
3850  T=T-1
3860  IF T>0 THEN 3730
3870  GOTO 3880
3880  REM COMPUTER MOVES
3890  T(1)=0
3900  FOR T2=1 TO 2
3910  FOR A=1 TO 47
3920  FOR B=1 TO 19
3930  IF M(A,B)<-4 THEN 3990
3940  NEXT B
3950  NEXT A
3960  IF T2=2 THEN 4630
3970  PRINT "I WON´T MOVE"
3980  GOTO 4630
3990  A1=A
4000  B1=B
4010  FOR C=1 TO 8
4020  A=A1
4030  B=B1
4040  GOSUB 5140
4050  IF  A=0 THEN 4070
4060  IF M(A,B)>0 THEN 4110
4070  NEXT C
4080  A=A1
4090  B=B1
4100  GOTO 3940
```

Keep 'em Flying

```
4110  GOSUB 5440
4120  M=M(A,B)
4130  IF INT(M)<>-6 THEN 4110
4140  A1=A
4150  B1=B
4160  C=INT(RND(1)*8)+1
4170  A=A1
4180  B=B1
4190  GOSUB 5140
4200  IF  A=0 THEN 4160
4210  N=M(A,B)
4220  IF N<1 THEN 4110
4230  IF N<>4 THEN 4260
4240  GOSUB 5920
4250  GOTO 4620
4260  A2=A
4270  B2=B
4280  IF N>4 THEN 4340
4290  PRINT "I TAKE";
4300  GOSUB 5480
4310  GOSUB 5690
4320  PRINT
4330  GOTO 4560
4340  PRINT "I ATTACK";
4350  GOSUB 5480
4360  IF RND(1)*(N+ABS(M)-10)>N-5 THEN 4600
4370  PRINT "SUCCESSFULLY"
4380  FOR X=A-1 TO A+1
4390  IF X<1 OR X>47 THEN 4440
4400  FOR Y=B-1 TO B+1
4410  IF Y<1 OR Y>19 THEN 4430
4420  IF M(X,Y)=1 THEN 4470
4430  NEXT Y
4440  NEXT X
4450  PRINT "YOUR MEN ARE TRAPPED AND DEAD"
4460  GOTO 4560
4470  PRINT "RETREAT ";
4480  A=A2
4490  B=B2
4500  GOSUB 5110
4510  IF  A=0 THEN 4470
4520  IF M(A,B)<>1 THEN 4470
4530  M(A,B)=(N-5)*RND(1)+5
4540  T(1)=A2
4550  T(2)=B2
4560  N=(M+5)*RND(1)
4570  M(A2,B2)=N-5
4580  M(A1,B1)=M-N
4590  GOTO 4620
4600  PRINT "IN VAIN"
4610  M(A1,B1)=(M+5)*RND(1)-5
4620  NEXT T2
4630  REM COMPUTEN SHOOTS
4640  Y=16
4650  GOSUB 5630
4660  FOR X=1 TO G
4670  GOSUB 5440
4680  IF M(A,B)<1 THEN 4670
4690  IF X=2 THEN 4710
4700  PRINT "ENEMY GUNS DESTROY";
4710  GOSUB 5480
4720  IF X=G THEN 4740
4730  PRINT "AND";
4740  GOSUB 5690
4750  M(A,B)=0
4760  GOSUB 5510
4770  NEXT X
4780  PRINT
4790  GOTO 2100
4800  REM  PRINT SUBROUTINE
4810  PRINT
4820  GOSUB 5080
4830  FOR V=19 TO 1 STEP -1
4840  IF V=INT(V/5)*5 THEN 4870
4850  PRINT " ";
4860  GOTO 4880
4870  PRINT "-";
4880  FOR U=1 TO 47
4890  W=M(U,V)
4900  IF W THEN 4930
4910  PRINT " ";
4920  GOTO 5030
4930  IF W<0 THEN 5020
4940  IF W<5 THEN 4970
4950  PRINT CHR$(48+INT(10*(W-5)));
4960  GOTO 5030
4970  IF W=1 THEN 5000
4980  PRINT MID$(S$,W*4-3,1);
4990  GOTO 5030
5000  PRINT ":";
5010  GOTO 5030
5020  PRINT MID$(C$,(3-P)/2,1);
5030  NEXT U
```





```
5040  IF V<>INT(V/5)*5 THEN 5060
5050  PRINT "-";
5060  PRINT
5070  NEXT V
5080  PRINT "     !    1    !    2    !    3    !    4    !"
5090  RETURN
5100  GOSUB 4800
5110  PRINT "DIRECTION";
5120  INPUT C
5130  IF C<1 OR C>8 THEN 5210
5140  IF C=8 THEN 5160
5150  B=B+SGN(4-C)
5160  IF C=2 THEN 5210
5170  IF C<>1 THEN 5200
5180  A=A-1
5190  GOTO 5210
5200  A=A+SGN(6-C)
5210  IF A>0 AND A<48 AND B>0 AND B<20 THEN 5230
5220  A=0
5230  RETURN
5240  GOSUB 4800
5250  PRINT "CO-ORDINATES";
5260  INPUT A,B
5270  IF A<1 OR B<1 OR A>47 OR B>19 THEN 5240
5280  RETURN
5290  PRINT ", CO-ORDINATES";
5300  GOSUB 5260
5310  N=M(A,B)
5320  IF N THEN 5350
5330  PRINT "THERE IS NOTHING THERE";
5340  GOTO 5290
5350  IF N>0 THEN 5380
5360  PRINT "THAT IS ENEMY TERRITORY";
5370  GOTO 5290
5380  IF N=1 OR N>4 THEN 5280
5390  PRINT "THERE IS ALREADY SOMETHING THERE";
5400  GOTO 5290
5410  GOSUB 5440
5420  IF M(A,B)<>-1 OR (A>21 AND A<26) THEN 5410
5430  RETURN
5440  A=INT(RND(1)*47)+1
5450  B=INT(RND(1)*19)+1
5460  IF M(A,B) THEN 5430
5470  GOTO 5440
5480  PRINT USING " (##!##) ";A,",",B;
5490 REM
5500  RETURN
5510  FOR E=A-1 TO A+1
5520  IF E<1 OR E>47 THEN 5610
5530  FOR F=B-1 TO B+1
5540  IF F<1 OR F>19 THEN 5600
5550  IF ABS(M(E,F))<>3 THEN 5600
5560  FOR K=2 TO 32 STEP 3
5570  IF G(K)=E AND G(K+1)=F THEN 5590
5580  NEXT K
5590  G(K-1)=-1
5600  NEXT F
5610  NEXT E
5620  RETURN
5630  G=0
5640  FOR X=Y TO (-(Y=16))*18+13 STEP 3
5650  IF G(X)<1 OR  G(X+1)=0 OR G=2 THEN 5670
5660  G=G+1
5670  NEXT X
5680  RETURN
5690  IF ABS(M(A,B))<>2 THEN 5750
5700  FOR K=1 TO 3 STEP 2
5710  IF B(K)=A AND B(K+1)=B THEN 5730
5720  NEXT K
5730  B(K)=0
5740  RETURN
5750  IF ABS(M(A,B))<>3 THEN 5800
5760  FOR K=2 TO 32 STEP 3
5770  IF G(K)=A AND G(K+1)=B THEN 5790
5780  NEXT K
5790  G(K)=0:  G(K-1)=0
5800  RETURN
5810  REM ANYWHERE TO DISTRIBUTE MEN?
5820  Q=1
5830  FOR A=T(3)-1 TO T(3)+1
5840  IF A<1 OR A>47 THEN 5900
5850  FOR B=T(4)-1 TO T(4)+1
5860  IF B<1 OR B>47 THEN 5890
5870  IF M(A,B)<>-1 AND (INT(M(A,B))<>-6 OR M(A,B)<5.89) THEN 5890
5880  Q=0
5890  NEXT B
5900  NEXT A
5910  RETURN
5920  PRINT "B"CHR$(7)"O"CHR$(7)"O"CHR$(7)"M   HIT MINE AT":
5930  GOSUB 5480
5940  PRINT
5950  M(A1,B1)=SGN(M(A1,B1))
5960  M(A,B)=0
```

ALL-AMERICAN

```
5970  RETURN
5980  PRINT "A LOBBY, HEADED BY THE DESTROY INTRANATIONAL STUPID"
5990  PRINT "COMPUTERS MOVEMENT OF THE "MID$(C$,2-P,2)"ST COAST HAS CONV
INCED"
6000  PRINT "THE GOVERNMENT TO OUTLAW COMPUTERS.  WE CANNOT ALLOW THIS."
6010  PRINT "THE "MID$(C$,2+P,2)"STERN STATES HAVE DECIDED TO SECEDE FRO
M"
6020  PRINT "THE UNION.  A BATTLE FRONT HAS DEVELOPED IN THE CENTRAL"
6030  PRINT "STATES.":  PRINT
6040  PRINT "YOU HAVE BEEN APPOINTED SECRETARY OF WAR.  YOU ARE TO WIN"
6050  PRINT "INDEPENDENCE FOR THE "MID$(C$,2+P,2)"ST, EVEN IF YOU HAVE T
O"
6060  PRINT "DESTROY THE ENTIRE CONTINENT.  WE MUST MAKE THE WORLD SAFE"
6070  PRINT "FOR COMPUTERS BY STOPPING THE D.I.S.C. MOVEMENT.":  PRINT
6080  PRINT "YOU WILL BE LOCATED AT A BASE.  FROM THERE, YOU ARE TO"
6090  PRINT "CO-ORDINATE ALL ACTIVITIES.  IF YOU CAN DESTROY THE"
6100  PRINT MID$(C$,2-P,2)"ST'S BASE, THEIR EFFORTS WILL BE HALTED AND"
6110  PRINT "COMPUTERS WILL BE SAFE.": PRINT
6120  PRINT "HIT RETURN WHEN YOU HAVE READ THIS FAR":  PRINT
6130  LINE INPUT X$
6140  PRINT "THE COUNTRY WILL BE REPRESENTED ON A 47 X 19 MAP:"
6150  GOSUB 4800
6160  PRINT "THE DOTS SHOW YOUR TERRITORY.  YOU WILL NOT BE SHOWN"
6170  PRINT "WHERE ANYTHING IS LOCATED IN THE "MID$(C$,2-P,2)"ST, BUT ON
LY"
6180  PRINT "WHICH LAND IW OCCUPIED.":  PRINT
6190  PRINT "BOTH SIDES WILL HAVE THE FOLLOWING:":  PRINT
6200  PRINT "BASE   LOSE IT AND THE WAR IS OVER.  THE CLOSER IT IS TO"
6210  PRINT TAB(7)"YOUR ARMIES, THE STRONGER THE ARMY.":  PRINT
6220  PRINT "GUNS   THESE ARE MISSILE SITES WHICH CAN LAUNCH MISSLES"
6230  PRINT TAB(7)"TO DESTROY ANYTHING.  THEY WILL HIT WITHIN ONE UNIT"
6240  PRINT TAB(7)"PROVIDED IT IS NOT SHOT OUT OF RANGE.  THE MAXIMUM"
6250  PRINT TAB(7)"RANGE IS BETWEEN 15 AND 25 UNITS.  IF OUT OF RANGE,"
6260  PRINT TAB(7)"IT MAY LAND ANYWHERE IN THE PATH.  YOU MAY NOT USE"
6270  PRINT TAB(7)"THE SAME GUN SIGHT TWICE IN A ROW.  ALSO, A GUN SIGHT
"

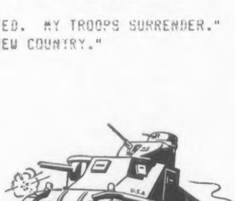
6280  PRINT TAB(7)"WILL BE INOPERATIVE FOR ONE TURN IF A MISSLE LANDS"
6290  PRINT TAB(7)"IN AN ADJACENT SPACE.  YOU WILL BE ALLOWED TWO SHOTS"
6300  PRINT TAB(7)"PER TURN.":  PRINT
6310  PRINT "ARMIES WILL BE REPRESENTED AS INTEGERS LESS THAN TEN, THE"
6320  PRINT TAB(7)"HIGHER THE NUMBER, THE STRONGER THE ARMY.  ARMIES SAN
"

6330  PRINT TAB(7)"BE USED AS DEFENSE OR OFFENSE.  THEY CAN PROTECT YOUR
"

6340  PRINT TAB(7)"BASE OR GUNS AGAINST ENEMY ARMIES OR ADVANCE INTO THE
"

6350  PRINT TAB(7);MID$(C$,2-P,2)"STERN TERRITORY.  ARMIES ARE THE ONLY"
6360  PRINT TAB(7)"OBJECTS WHICH MAY ADVANCE INTO AND CAPTURE ENEMY"
6370  PRINT TAB(7)"TERRITORY.  ARMIES WILL ALSO BE REFERED TO AS FORCES.
"

6380  PRINT TAB(7)"YOU WILL BE GIVEN REIFORCEMENTS AFTER WINNING A BATTL
E."
6390  PRINT TAB(7)"THE MORE LAND YOU CONTROL, THE HIGHER REINFORCEMENT"
6400  PRINT TAB(7)"STRENGTH.":  PRINT
6410  PRINT "MINES  ARE USED AS DEFENSE AGAINST ENEMY ARMY ATTACKS."
6420  PRINT TAB(7)"THEY WILL DESTROY ANY ATTACKING ARMY.":  PRINT
6430  PRINT "IDENTIFICATION OF OBJECTS WILL BE BY CO-ORDINATES, COLUMN,"
6440  PRINT "ROW, STARTING FROM THE LOWER LEFT OF THE MAP."
6450  PRINT "INVALID CO-ORDINATES, SUCH AS 0,0 WILL GIVE AN       1 2 3"
6460  PRINT "UPDATED MAP.  MOVEMENTS CAN BE MADE ONE UNIT IN      8 + 4"
6470  PRINT "ANY DIRECTION.  DIRECTIONS ARE LABLED AT THE         7 6 5"
6480  PRINT "RIGHT.":  PRINT
6490  PRINT "THE FOLLOWING IS TO SET UP THE GAME.  ENTER WHERE ON THE MA
P"
6500  PRINT "YOU WISH EACH TO BE PLACED.": PRINT
6510  GOTO 1290
6520  PRINT "BOTH OF OUR BASES HAVE BEEN DESTROYED.  FOREIGN POWERS"
6530  PRINT "WILL MOVE IN AND TAKE OVER."
6540  GOTO 6560
6550  PRINT "YOU AND YOUR COMMAND HEADQUARTERS HAVE BITTEN THE DUST"
6560  PRINT "FOR BEING KILLED, YOU HAVE JUST BEEN FIRED AS LEADER"
6570  PRINT "OF THE REVOLUTION.  COMPUTERS WILL NEVER FORGIVE YOU."
6580  GOTO 6610
6590  PRINT "MY HEADQUARTERS HAS BEEN DESTROYED.  MY TROOPS SURRENDER."
6600  PRINT "YOU ARE NOW THE LEADER OF YOUR NEW COUNTRY."
6610  L(1)=0:  L(3)=0
6620  FOR X=1 TO 47
6630  FOR Y=1 TO 19
6640  IF  M(X,Y)=0 THEN 6660
6650  L(SGN(M(X,Y))+2)=L(SGN(M(X,Y))+2)+1
6660  NEXT Y
6670  NEXT X
6680  A=276
6690  B=292
6700  IF P$="E" THEN 6740
6710  B=A
6720  A=292
6730  PRINT "PERCENTAGES OF LAND LEFT:"
6740  PRINT "YOUR LAND"L(3)/B*100
6750  PRINT MID$(C$,2-P,2)"ST LAND"L(1)/A*100
6760  PRINT: PRINT "TOTAL PERCENT LAND LEFT"(L(1)+L(3))/5.68
6770 END
Ok
```



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- Dual Cassette I/O
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Modular design allows use of both cassettes for programs and ROM PAC cartridges for future language introductions like: APL, COBOL, PILOT, FORTRAN, etc. Add monitor and tape or disk for complete computer system.

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| 16K | $1145 |
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707-448-9055

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PITMAN, NEW JERSEY 08071
(609) 589-5500

## products for the APPLE II

**APPLESOFT II UTILITY** (Diskette Only) **$12.45**

The Applesoft II Utility program provides the user with the following features. a) Complete automatic renumbering of any Applesoft II program. b) The creation of an EXEC File for subroutine file creation. This feature allows you to incorporate the same subroutine in various programs. c) No modification of the program in machine memory (RAM). d) Automatic running of the program. No programmer should be without this excellent utility program. REQUIREMENTS: Disk II, Applesoft II, 16K of memory.

**REAL ESTATE ANALYSIS PROGRAM** **$14.95**

The Real Estate Analysis Program provides the user with three features. a) A powerful real estate investment analysis for buy/sell decisions and time to hold decisions for optimal rental/commercial investments. b) Generation of complete amorization schedules consistent with banking practices and schedules. c) Generation of depreciation schedules for selecting the best depreciation schedule for your use and a determination of optimal switch over points to straight line to maximize depreciation. All three features are designed for video screen or printer output. In addition, the program will plot: cash flow before taxes vs. years, cash flow after taxes vs. years, adjusted basis vs. years, capital gains vs. years, pre-tax proceeds vs. years, post-tax proceeds vs. years, and return on investment (%) vs. years. REQUIREMENTS: Applesoft II, 16K of memory without DOS or 32K of memory with DOS (Disk II).

**ADDRESS FILE GENERATOR** **$19.95**

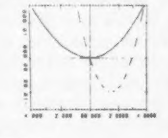
A professional piece of software which allows the user to create four different types of address files: a) Holiday File, b) Birthday File, c) Home Address File, and d) Commercial Address File. The program contains a menu of seven major commands: 1) Create a File, 2) Add to File, 3) Edit File, 4) Display File, 5) Search File, 6) Sort File, and 7) Reorganize File. Most of the major commands have subordinate commands which adds to the flexibility of this powerful software system. We doubt you could buy a better program for maintaining and printing address files. REQUIREMENTS: Disk II, Apple Printer Card, 32K of memory with Applesoft ROM Card or 48K of memory without Applesoft ROM Card.

**SUPER CHECKBOOK** **$19.95**

A totally new checkbook program with a unique option ... Bar Graphs. These bar graphs, outputed to a printer or video screen, provide trend analysis data on code expense, income, expenses, or gain/loss on a month by month basis. The program contains a total of fourteen options. 1) Check/Deposit Entry & Modification, 2) Reconciliation of Checks or Deposits, 3) Sort by Check Number, 4) Sort by Code for Year, 5) Sort by Code for Month, 6) Output Year to Date, 7) Output Month Activity, 8-11) Printer/Video Plot Trend Analysis-Bar Graphs, 12) Account Status, 13) Reconciled Check Status, and 14) Quit. An excellent program for maintaining your checkbook, or that of a small business. REQUIREMENTS: Disk II, 32K of memory with Applesoft ROM Card or 48K of memory without Applesoft ROM Card.

**FUNCTION GRAPHS AND TRANSFORMATIONS** **$14.95**

This program uses the Apple II high resolution graphics capabilities to draw detailed graphs of mathematical functions which the user defines in Basic syntax. The graphs appear in a large rectangle whose edges are X and Y scales (with values labeled by up to 6 digits). Graphs can be superimposed, erased, drawn as dashed (rather than solid) curves, and transformed. The transformations available are reflection about an axis, stretching or compressing (change of scale), and sliding (translation). The user can alternate between the graphic display and a text display which lists the available commands and the more recent interactions between user and program. Expected users are engineers, mathematicians, and researchers in the natural and social sciences; in addition, teachers and students can use the program to approach topics in (for example) algebra, trigonometry, and analytic geometry in a visual, intuitive, and experimental way which complements the traditional, primarily symbolic orientation. REQUIREMENTS: 16K of memory with Applesoft ROM Card or 32K of memory without Applesoft ROM Card.



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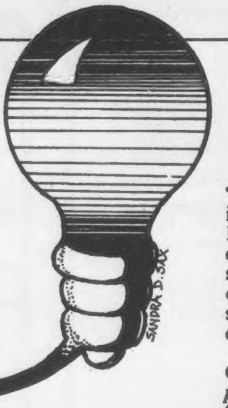
**CIRCLE 171 ON READER SERVICE CARD**

# Compleat Computer Catalogue



We welcome entries from readers for the "Compleat Computer Catalogue" on any item related, even distantly, to computers. Please include the name of the item, a brief evaluative description, price, and complete source data. If it is an item you obtained over one year ago, please check with the source to make sure it is still available at the quoted price.

Send contributions to "The Compleat Computer Catalogue," *Creative Computing*, P.O. Box 789-M, Morristown, NJ 07960.

## COMPUTERS

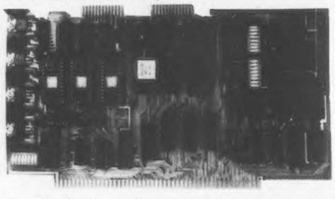
### ENHANCED APPLE II

Apple Computer, Inc., has announced the Apple II Plus, an enhanced version of the Apple II computer offering resident Applesoft extended BASIC language and a new Auto-Start control ROM for simplified start up and screen editing. The systems are priced as follows: 16K, $1,195; 32K, $1,345; and the 48K, $1,495.

Apple Computer, Inc., 10260 Bandley Dr., Cupertino, CA 95014, (408) 996-1010.

**CIRCLE 225 ON READER SERVICE CARD**

### 5 MHz CPU CARD



A single-board microcomputer that uses Intel's new 8085A-2 microprocessor to permit operation at 5 MHz has been introduced by Artec Electronics, Inc. The S-100 CPU card is suitable for industrial and process control applications, business processing, and personal computing. The new CPU card features a hardware floating point that uses AMD's AM9511 math chip to perform additional operations in 175 milliseconds (ms) and multiplication typically in 168 ms. $850.

Artec, 605 Old County Road, San Carlos, CA 94070, (415) 592-2740.

### SYSTEM-Z

The System-Z does accounting, secretarial, and personal jobs. The hardware features of our standard system are: Z-80 processor, S-100 bus, 32K RAM, full-sized floppy disk drive, video monitor, keyboard and CP/M operating system. The System-Z runs a dozen languages, and the software library offers over 500 application programs. $2899.

MicroDaSys, P.O. Box 36051, Los Angeles, CA 90036, (213) 935-4555.

**CIRCLE 226 ON READER SERVICE CARD**

### BOOKLET ON COSMAC MICROBOARD COMPUTER SYSTEMS

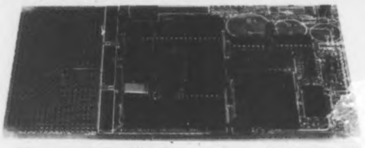
RCA Solid State
COSMAC Microboard Computer Systems

A 12-page booklet "COSMAC Microboard Computer Systems," CMB-250, describing a new line of milliwatt-operated, easy-to-use computer, memory, I/O, and control units is available from RCA Solid State. The booklet describes the basic features of the three Microboard Computer systems, CDP18S601, CDP18S602, and CDP18S603. 1 copy free.

RCA Solid State Division, Box 3200, Somerville, NJ 08876.

**CIRCLE 227 ON READER SERVICE CARD**

### SINGLE CARD COMPUTER



Pragmatic Designs has introduced CPU-1, an 8085 based microcomputer designed specifically for dedicated control applications. CPU-1 contains a 3 MHz 8085 microprocessor. The basic system contains 256 bytes of RAM, 22 I/O lines, one serial I/O port, and one programmable counter/timer. The system comes with an RC clock, and an optional crystal is available for users with applications requiring precise timing. The system has both power on reset and a manual reset button, and the 8085's vectored interrupt structure is supported. $125 kit, $175 assembled. CPU-1A (512 byts RAM, 44 I/O lines, two timers) $160 kit, $210 assembled.

Pragmatic Designs Inc., 711 Stierlin Road, Mountain View, CA 94043, (415) 961-3800.

**CIRCLE 228 ON READER SERVICE CARD**

### INFORMER 3

Informer 3's hardware consists of a Z-80 microprocessor, 48K of RAM, two RS-232 serial interface ports, one parallel interface port, 2K prom monitor, 8 inch floppy disk, and a 24 x 80 character CRT terminal. Software includes Floppy Basic (an extended disk basic), diagnostics, and basic utilities, which includes file copy and disk copy for either single or multiple

drive systems. Present business software includes Inventory Management, Payroll, Accounts Payable and Receivable, Word Processing, Customer Mailing List, General Ledger, Program Development, and others. $4000.

DDS, Division of Rohner Machine Works, 7th and Elm, West Liberty, IA 52776.

**CIRCLE 229 ON READER SERVICE CARD**

## MULTI-STATION WORD PROCESSOR

A low cost, multi-station word processor that simplifies office document preparation and can also run an accounting package has been introduced by Computer Management Group, Inc.. The CMG Omicron Word Processor incorporates a Zilog microprocessor, printer, 12" diagonal CRT with keyboard, and 2 floppy drives with 600,000 character storage. $12990.

Computer Management Group, Inc., P.O. Box 4721, Elm St., Merrimack, NH 03054, (603) 424-9947.

**CIRCLE 230 ON READER SERVICE CARD**

## APPLE BUSINESS SYSTEM

Apple Computer has introduced the Apple II Business System. This configuration includes the Apple II Plus Computer, with 48K bytes of RAM memory, two disk drives, a video monitor, a printer, and CONTROLLER software package. The CONTROLLER business system consists of three program modules: the General Ledger module, the Accounts Receivable module, and the Accounts Payable module. $4995.

Apple Computer, Inc., 10260 Bandley Dr., Cupertino, CA 95051, (408) 996-1010.

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DISK DRIVES
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**200NS 16K Dynamic RAM Memory Kit.** NEC chips. Includes jumpers and instructions for installing in TRS-80 keyboard unit or expansion interface. (Specify keyboard or interface.)

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**BYTE-SIZE SYSTEMS, INC.**
Box 1370,
Manchester Center, VT 05255

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**SLOT MACHINE**
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**CHB SOFTWARE**
1026 W. 26th Street
San Pedro, CA 90731

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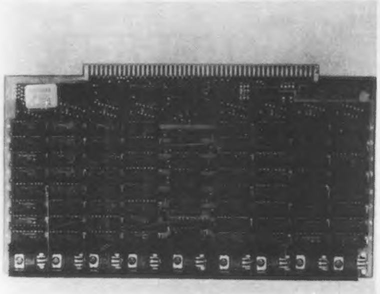
# MEMORY

## 32K RAM MEMORY BOARD



Tarbell Electronics has announced a 32K Static RAM board. The new memory board is S-100 bus compatible and runs at 300ns. It features extended addressing, or bank switching, and contains nine regulators which enhance its heat distribution. The same board is available with only 16K, leaving half of the board open for future addition of chips. The 16K version is also assembled and tested. The 32K RAM Board is priced at $625; the 16K version is priced at $390.

Tarbell Electronics, 950 Dovlen Place, Suite B., Carson, CA 90746, (213) 538-4251 or 538-2254.

**CIRCLE 232 ON READER SERVICE CARD**

## NEW POWER TO APPLES WITH ROMPLUS + BOARD

Mountain Hardware, Inc., a major supplier of microcomputer peripherals, has introduced its ROMPLUS+ board for Apple Computers.

The new board offers six individually addressable sockets for 2K ROM's or EPROM's plus scratchpad RAM. Sophisticated on-board firmware allows two or more 2K ROM's to be utilized simultaneously for programs longer than 2K.

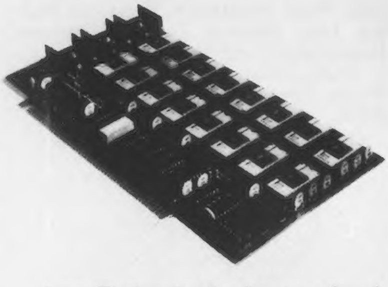
Also included is a 2K ROM program, "Keyboard Filter TM" which offers upper/lower case for the Apple, multiple user-defined character sets, colored or inverse-colored letters, keyboard macros, improved cursor control and other improved control functions. The program works with Integer BASIC, RAM or ROM Applesoft and DOS.

Software support, provided on disk, includes demonstration programs and two Editors that allow users to define their own characters and keyboard macros, including BASIC and DOS commands. Price: $169.00.

Avery Dee, Mountain Hardware, Inc., 300 Harvey West Blvd., Santa Cruz, CA 95060.

**CIRCLE 233 ON READER SERVICE CARD**

## 16K PROM CARD

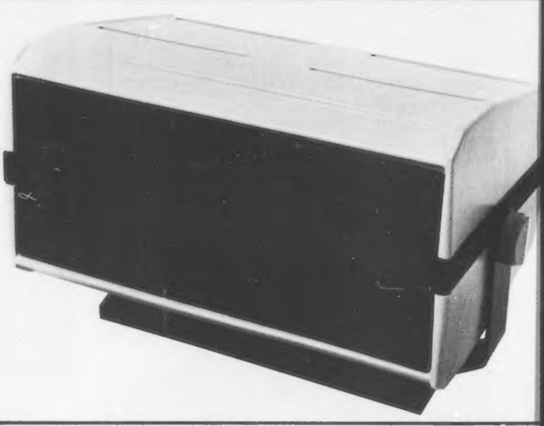


Artec Electronics, Inc. has introduced a full-feature memory card using 16K bits of 2708-type EPROM memory to permit expansion of S-100 microcomputer systems. The new card's 16K of memory are addressable in four 4K groups. A bank select feature, which controls up to eight banks of memory, allows any 4K group to be addressed to any 4K boundary. Features of the card include fully buffered data and address lines; onboard regulators and heat sinks that allow cool, problem-free operation; and switch-selectable wait states (04). $300.

Artec, 605 Old County Road, San Carlos, CA 94070, (415) 592-2740.

**CIRCLE 234 ON READER SERVICE CARD**

SORCERER COMPUTER



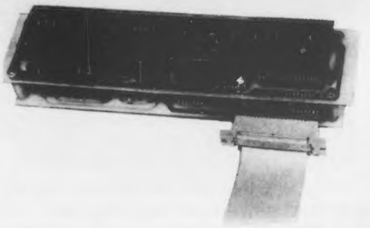
For A Demonstration Or Further Information Contact Your Local Computer Store.

Exidy inc. #1

CIRCLE 199 ON READER SERVICE CARD

# TERMINALS & I/O

## DE/432 NEW PRODUCT ANNOUNCEMENT



Digital Electronics Corporation has announced the DE/432 Intelligent Random Access Display Module including on-board microprocessor. The DE/432 features vacuum fluorescent display technology of 32 characters/columns, 0.02 inch (5mm) character height, 5x7 dot matrix with character generation of the full ASCII 96-character set. Standard with the unit are a self test mode of all characters, automatic flashing of any or all characters, programmable cursor-blinking or invisible. $265 per 100.

Digital Electronics Corporation, 197 Airport Blvd., Burlingame, CA 94010, (415) 342-8333.

**CIRCLE 235 ON READER SERVICE CARD**

## COLOR MONITORS

Videcom color monitors have been designed for CCTV, studio and computer display applications. Picture tube sizes measure 13" and 19" diagonally. The chassis is 100% solid state design. Input and output signals are electrically isolated from the chassis and AC line for protection of personnel and other equipment connected. TC 900, $675; TC 700, $550.

Videcom, Division of General Technical Products, Inc., Box 339, Warrington, PA 18976, (215) 343-3000.

**CIRCLE 236 ON READER SERVICE CARD**

## OPTICALLY ISOLATED I/O BOARD

A programmable I/O board which optically isolates the central computer system from high voltage devices is available from National Semiconductor's Microcomputer Group. The BLC-556 eliminates the effects of ground loops and protects the CPU from voltages up to 500 VDC by using optical interface coupling. Typically the BLC-556 is used to control SCRs, TRIACs, relays, motors, and solenoids. The board has 48 data lines. $355 for 1-9.

National Semiconductor, 2900 Semiconductor Dr., Santa Clara, CA 95051, (408) 737-5000.

**CIRCLE 237 ON READER SERVICE CARD**

## ACOUSTIC COUPLER/MODEM

Tek-Com, Inc. has announced the TC3001, a Bell compatible 103/113 unit. The TC3001 provides all of the portability of an acoustic coupler and the reliability of a state-of-the-art modem. TC3001 has been designed to optimize the transfer of low-speed data over normal voice grade telephone lines using an ordinary telephone handset. Features include: 300 baud asynchronous data rate, acoustic and DAA/private line interfaces, half/full duplex, simultaneous EIA RS-232 and 20 mA interfaces and power and carrier indicators. $265.

Tek-Com, 1147 Sonora Ct., Sunnyvale, CA 94086, (408) 736-3282.

**CIRCLE 238 ON READER SERVICE CARD**

| *FEATURES | EXIDY SORCERER | TEXAS INSTRUMENTS 99/4 | ATARI 800 | APPLE II | COMPUCOLOR MOD III | COMMODORE PET | TANDY TRS-80 |
|---|---|---|---|---|---|---|---|
| Price of Minimum Configuration | $995 | $1150 | $999.99 | $1150 | $1495 | $795 | $599 |
| Computer Type | Z80 | 9900 | 6502 | 6502 | 8080 | 6502 | Z80 |
| Maximum RAM in Unit | 48K | 16K | 49.1K | 48K | 32K | 8K | 16K |
| ROM Supplied | 12K | 26K | 16K | 8K | 17K | 14K | 4K |
| Display | B/W | Color | Color | Color | Color | B/W | B/W |
| CHAR/Line | 64 | 32 | 40 | 40 | 64 | 40 | 64/32 |
| Line/Screen | 30 | 24 | 24 | 24 | 16/32 | 25 | 16 |
| Graphic Resolution | 512/240 | 192/256 | 380/192 | 280/192 | 128/128 | 320/200 | 128/48 |
| Keyboard | 79 Key Typewriter | 40 Key Calculator | 57 Key Typewriter | 52 Key Typewriter | 77 Key Typewriter | 73 Key Calculator | 53 Key Typewriter |
| Lower Case Standard | Yes | No | No | No | No | No | No |
| Numeric Keypad Standard | Yes | No | No | No | Yes | Yes | No |
| Programmable Characters Standard | 128 | No | No | No | No | No | No |
| I/O Electronics Included | Dual Cassette<br>RS232<br>Communications<br>8 Bit Parallel | Joystick<br>Sound | Joystick<br>Serial<br>Single Cassette | Single Cassette<br>Joystick | Single Disk<br>RS232<br>Communication | Single Cassette<br>IEEE 488 | Single Cassette |
| Expansion Bus | S-100 | No | No | Yes | Yes | IEEE 488 Daisy Chain | Yes |
| Disk Available | 630K Byte | No | 92K Byte | 116K Byte | 51.2K Byte | 125K Byte | 45K Byte |
| System Software Available | ROM Basic<br>ROM Assembler<br>ROM Word Processor<br>CPM EXT. Basic<br>CPM Fortran<br>CPM Cobol<br>CPM APL<br>CPM Pascal | ROM Basic | ROM Basic<br>ROM Assembler | ROM Basic<br>Disk Basic<br>Pascal | Disk Basic | ROM Basic<br>Disk Basic | ROM Basic<br>Disk Basic<br>Cassette Assembler |

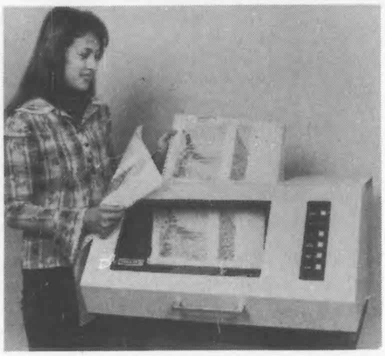
rices and specifications available June 1979.

390 Java Ave. Sunnyvale CA. 94086 (408) 734-9410

CIRCLE 199 ON READER SERVICE CARD

## TERMINALS & I/O

### DOT MATRIX PLOTTER



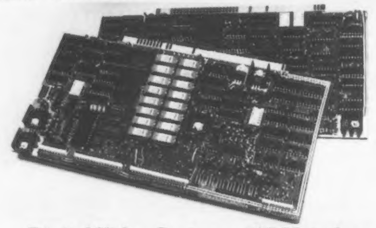
Trilog, Inc. has introduced the T-100 impact dot matrix plotter. It has been engineered to interface with Printronix plot software and has plug compatibility with Printronix, Centronics and Data Products printers. The T-100 utilizes raster matrix technology to plot at 15 inches per minute with a dot density of 100 dots per inch. $7230.

Trilog, Inc., 16705 Hale Ave., Irvine, CA 92714, (714) 549-4079.

**CIRCLE 239 ON READER SERVICE CARD**

### S-100 PLUG-IN UNIT

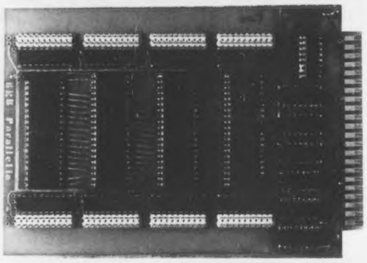
A complete video imaging and graphics system with real-time TV frame grabber which plugs into the S-100 bus has been introduced by Digital Video Systems of Palo Alto, CA. The CAT-100 is a compact two-board color video imaging system with the resolution and many of the capabilities of higher priced systems as well as unique features of its own. It offers three fundamental functions: a video frame digitizer, an image memory, and an output video generator. The digitizer can capture a video frame in 1/60th of a second and store it in the on-board 32K-byte image memory. The video generator displays the digitized image in 16 shades of gray or 16 colors on standard low-cost black and white or color TVmonitors. It can also directly drive a high-resolution RGB monitor. $893 - $1992.80.



Digital Video Systems, 595 Matadero Avenue, Palo Alto, CA 94306. (415) 494-6088, J. Robert Flexer.

**CIRCLE 240 ON READER SERVICE CARD**

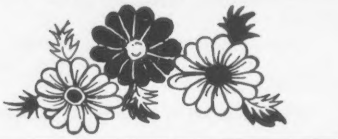
### PARALLEL I/O MODULE



Wintek's parallel 1/0 module allows up to 64 input/output lines organized as eight 8-bit ports on a 4½" x 6½" module. Each 8-bit port is programmable as input or output. For each port there are 2 programmable control lines for automatic handshake protocols including maskable or unmaskable interrupts. Each output line is fully buffered for 15 TTL loads. The module can be supplied with 2, 4, 6, or 8 ports at quantity 100 prices $59, $89, $119, $149 respectively.

Wintek Corporation, 902 N. 9th Street, Lafayette, IN 47904, (317) 742-6802.

**CIRCLE 241 ON READER SERVICE CARD**



**** TRS 80 DISK BASED BUSINESS SOFTWARE ****

ALL PACKAGES UTILIZE RANDOM ACCESS. EXTENSIVE ERROR TRAPPING, EFFICIENT CODE, FOLLOW-UP ASSISTANCE, USER DESIGNED SCREENS, AND MUCH MORE. WE'RE NOT "CHEAP" BUT WE'RE DE-BUGGED.

| | |
|---|---|
| INVENTORY | REPORTING INCLUDES SLS, RE-ORDER, O1h, VEN, COST, REC. RANDOM ACCESS BY ITEM # OR BY STOCK #. 100 VENDORS 1400 ITEMS. |
| GENERAL LEDGER | 200 ACCTS + CONTRA (USER DEFINED). TRAIL BAL, P&L, BAL SHEET, JOURNAL LISTING, CHART OF ACCTS. DOESN'T ACCEPT O/B JOURNALS. |
| PAYROLL | SAL/HRLY INS DED + 2 MISC. FULL REPORTING FICA, STATE, FED, F.U.T.A. 80 + EMPLOYEES. |
| ACCTS REC | BAL FWD, AGING AND BILLING RPTS. RECORDED BY INV # OR CHECK #. 300 ACCTS. |
| MAIL/LIST | SORT BY ZIP, NAME, USER CODES. FULL OR PARTIAL PRINTING. 4 LINES N/A. SUPPORTS 900. |
| GAMES PACK | 6 GAMES INCLUDING 80-OUT (BREAKOUT). DISK OR TAPE. TAPE (16K LEVEL 2) DISK (32K RAM) |

WHOOPS I'M RUNNING OUT OF ROOM
PRICES: INVEN, G.L., PAYROLL, A/R $265.00
MAIL/LIST 79.95 GAMES PACK $ 39.95

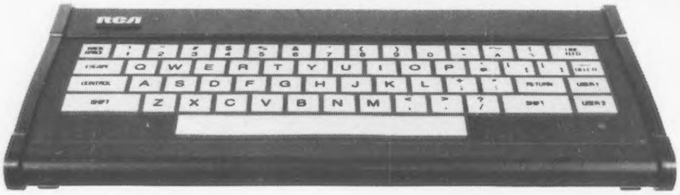
ALSO AVAILABLE JOB COSTING* PAYABLES, AND CUSTOM APPLICATIONS AND FREE UP TO DATE INFORMATION ABOUT NEW AND FUTURE TRS-80 PRODUCTS.

AFFORDABLE BUSINESS SYSTEMS INC.
2101 E. BROADWAY RD., SUITE NO. 11
TEMPE, AZ 85282 TEL.: 602-966-3339

SPEND A DIME AND CALL FOR MORE INFORMATION

CIRCLE 105 ON READER SERVICE CARD

ASCII encoded keyboards as low as $65.*



The RCA VP-601 keyboard has a 58 key typewriter format for alphanumeric entry. The VP-611 ($15 additional*) offers the same typewriter format plus an additional 16 key calculator type keypad.

Both keyboards feature modern flexible membrane key switches with contact life rated at greater than 5 million operations, plus two key rollover circuitry.

A finger positioning overlay combined with light positive activation key pressure gives good operator "feel", and an on-board tone generator gives aural key press feedback.

The unitized keyboard surface is spillproof and dustproof. This plus the high noise immunity of CMOS circuitry makes the VP-601 and VP-611 particularly suited for use in hostile environments.

The keyboards operate from a single 5 volt, DC power supply, and the buffered output is TTL compatible. For more information contact
RCA VIP Marketing, New Holland Avenue,
Lancaster, PA. Telephone (717) 291-5848.

RCA

*Optional user price. Dealer and OEM prices available.

CIRCLE 176 ON READER SERVICE CARD

## AN INTELLIGENT PRINTER FOR UNDER $400

The Trendcom 100 Intelligent Printer provides the microcomputer user with 40-column hard copy on 4½" wide paper. Interfaces are available for TRS-80, Apple II, PET and Sorcerer.

Features include bidirectional 40 character-per-second printing with a full 96-character ASCII set, upper and lower case letters, numerals and punctuation marks. 5 by 7 dot-matrix characters are printed with either black or blue images, depending upon the paper used. The unit is quiet since it uses no print hammers, gears or drive belts. It uses a thick film thermal print head to eliminate the wear and reliability problems. Available in both 115 VAC and 230 VAC. Price: $375. Quantity OEM discounts available.

Trendcom, 484 Oakmead Parkway, Sunnyvale, CA 94086, (408) 737-0747.

CIRCLE 242 ON READER SERVICE CARD

## HIGH RESOLUTION TERMINAL

Intelligent Systems Corporation has announced high resolution capabilities for their Intecolor 8001G color graphic CRT terminals. Each character is comprised of 6 X 8 dot matrix, with all 48 dots addressable by software. Intecolor high resolution graphics hardware consists of 512 software programmable characters. Random vectoring and symboling resolution is equal to 480 X 384. A pioneer in low-cost color graphics, the company already produces 80% of the color units used in the process control industry. They are now producing high resolution color at black and white prices. The 8001H operates in three main modes, eight foreground and background colors, with an 8080A microprocessor and a color and numeric keyboard. RS-232C interfacing capabilities plus 2K of ROM are standard. $3650.

Intelligent Systems Corporation, 5965 Peachtree Corners E., Norcross, GA 30071, (404) 449-5961.

CIRCLE 243 ON READER SERVICE CARD

## LOW-COST PRINTER FROM JAPAN

Super Brain, Inc. has introduced their 80-column printer in the U.S. Super Brain Model LP-80 is a bi-directional, dot matrix impact printer with a print head designed for 100% duty operation, assuring a print life that exceeds 100 million characters. A precision sprocket feed mechanism permits printing forms from 4½" to 9½" wide. A 96-ASCII character set prints in upper and lower case with the added capability of producing double-width fonts in bold face.

The Vertical Format Unit provides preprogrammed/programmable tab positions, Top of Form, and Bottom of Form for complete formatting capabilities. It provides quiet operation.

There is a 90-day warranty on parts and labor. Price: $985 individually; available to quantity OEM buyers at discounts.

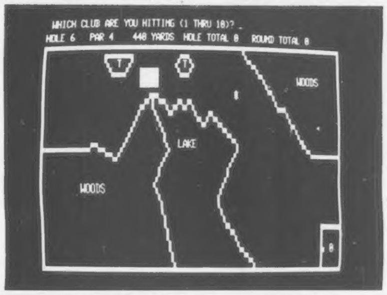
Super Brain, Inc., P.O. Box 403, Los Angeles, CA 90073, (213) 477-5992.

CIRCLE 244 ON READER SERVICE CARD

*Introducing . . .*

**Graphic Golf**

**TRS-80*** * trademark of Tandy Corp **Level II 16K**



```
WHICH CLUB ARE YOU HITTING (1 THRU 18)? _
HOLE 6   PAR 4   440 YARDS  HOLE TOTAL 0   ROUND TOTAL 0
```

Welcome to "Small Woods Country Club," where you can play on our scenic 18 hole, par 72, 6,840 yard course. Will you make it over the lake, or take the long way? You choose the club and angle, 80% skill, 20% chance. A challenge to all. Plays like a real course. Instruction tape included. Easy to order . . . 15⁹⁵

*Send check or money order to . . Ken Smallwood*
*(Calif. residents add **6%**) 389 Coral St.*
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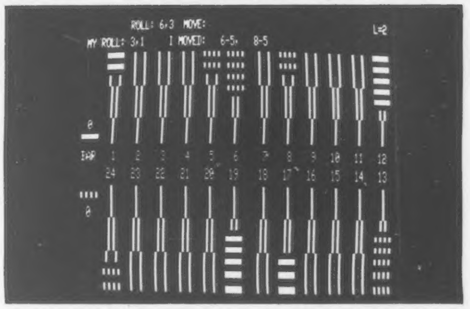
Dealer inquiries invited

CIRCLE 144 ON READER SERVICE CARD

**MICRO-BACKGAMMON**



```
ROLL: 6-3  MOVE:
MY ROLL: 3-1   I MOVED:  6-5,  8-5
```

**FOR YOUR TRS-80**

**MICRO-BACKGAMMON 1.5** offers 3 levels of play to please everyone from beginner to expert! All moves are checked for legality and displayed both graphically and literally. You can set up, adjust, and play from any position and dice roll or even watch the computer play against itself! The graphics alone will fascinate you. Included is a complete instruction booklet and easy to load cassette.

For Level I and Level II 4K TRS-80's .........**$19.95**

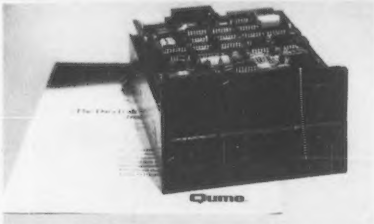
*Check, money order, VISA, or Mastercharge accepted. (Price includes shipping).*

**Questar Software**
**P.O. Box 723-C8, Wichita, Kansas 67201**

CIRCLE 175 ON READER SERVICE CARD

# FLOPPY DISCS

## DOUBLE-SIDED MINIFLOPPY



Qume Corporation has announced a 5¼-inch double-sided, double-density floppy disk drive, the DataTrak 5. The double-sided minifloppy has an unformatted data storage capacity of 437.5 kilobytes and a formatted capacity of 286.7K bytes. $465.

Qume Corp., P.O. Box 50039, San Jose, CA 95150, (408) 942-4000.

**CIRCLE 245 ON READER SERVICE CARD**

## PET ONE MEGABYTE DISK SYSTEM

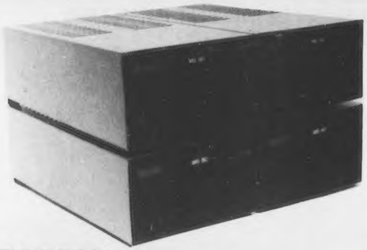
The PEDISK System 4 from CGRS Microtech is a full size 8" floppy disk/memory expansion system for the Commodore PET Computer. Each eight inch standard disk drive provides 250K-bytes totaling 1 megabyte of on-line mass storage when the system is expanded to a maximum of four drives. The PEDISK System 4 includes a built-in memory expansion in the form of a S100 bus adaptor and a 5 slot S100 motherboard. The PEDISK System 4 with 5 slot S100 motherboard and expansion chassis and a single 8" disk drive sells for $1495. Additional disk drives are available for $995.

CGRS Microtech, P.O. Box 368, Southampton, PA 18966, (215) 757-0284.

**CIRCLE 246 ON READER SERVICE CARD**

## MS-80 MINI DISK

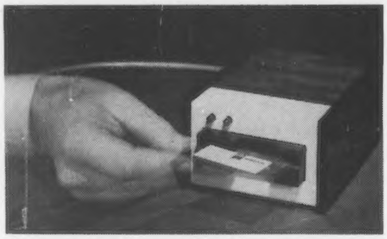
Matchless Systems has introduced the new MS-80 Mini Disk System, for TRS-80 owners. The system includes a minifloppy disk drive, power supply, cable, regulator board and a compact case. It increases usable storage from 55,000 to 67,800 bytes on the first drive. It is compatible with the TRS-80 DOS.



Matchless Systems, Dept. Pl, 18444 South Broadway, Gardena, CA 90248, (213) 327-1010.

**CIRCLE 247 ON READER SERVICE CARD**

## MASS STORAGE SYSTEM



Exatron Corporation has announced the TRS-80 Model and the SWTPC Model of the Exatron Stringy Floppy, mass storage subsystem for microcomputer

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Here are a few highlights from our new catalog:

**FILEMASTER** 2 Programs: *FORMAT & RETRIEVAL* comprise a powerful Data File Manager. Great for everything from phone lists to legal abstracts. Design your own data structure. Up to 500 Char. per sec. Up to 15 searchable fields in any combo. Needs 32K.Disk. . . . $34.95

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**POT O' GOLD** Our all new collection of 49 programs for 16K apple. Everything from logic to action games. Only a buck a game.
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**ADVENTURE** Fight off pirates and vicious dwarfs. 700 travel options, 140 locations, 64 objects. Needs Applesoft & 48K . . . . . Disk $29.95

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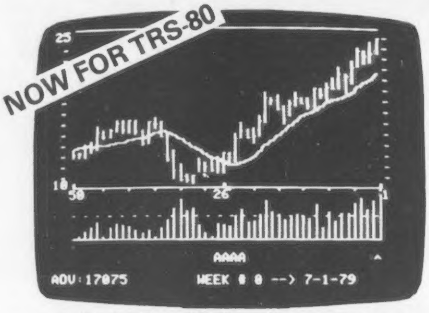
For The Apple II With Disk II



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- ONE YEAR'S WORTH OF WEEKLY STOCK DATA (HIGH, LOW, CLOSE & VOLUME) ON YOUR CHOICE OF ANY STOCKS ON THE NYSE OR AMEX
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  STOCK DATA. . . . . . . . . . . . . . . . . $9.95 per stock
  MANUAL ONLY. . . . . . . . . . . . . . . $4.95
- FOR MORE INFORMATION VISIT YOUR LOCAL COMPUTER STORE OR WRITE DIRECTLY TO:

RTR SOFTWARE INC.
DEPT. CC 10
P.O. BOX 12351
EL PASO, TX. 79912

master charge VISA

CIRCLE 177 ON READER SERVICE CARD

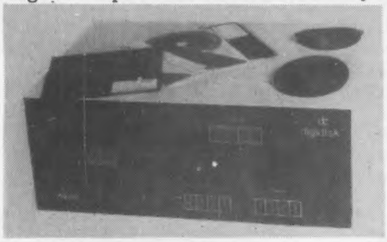
systems. The TRS-80 Model of the Stringy Floppy consists of one small freestanding module enclosing the drive unit, control electronics, and firmware; a sealed-unit power supply for the AC outlet; and a ribbon connector to the TRS-80. The SWTPC Model consists of a freestanding drive module, a controller board mounted in the computer motherboard, and a connecting cable. $199.50.

Exatron, 3555 Ryder St., Santa Clara, CA 94086, (408) 737-7111.

**CIRCLE 248 ON READER SERVICE CARD**

## MINI-FLOPPY DISK DRIVE

A microprocessor-based mini-floppy disk drive that emulates paper tape and magnetic tape has been introduced by Digicom Data Products, Inc. The Digidisk system allows the operator to prepare and edit messages and data off-line for future retrieval or on-line transmission. The unit will operate with any data communication printer or CRT terminal through the standard RS-232 interface. With standard RS-232 interface $1495, and $1595 with built-in 300-baud originate-only coupler.



Digicom Data Products, Inc., 1440 Koll Circle, Suite 108, San Jose, CA 95112, (408) 279-8711.

**CIRCLE 249 ON READER SERVICE CARD**

## MEMORY FOR PET AND TRS-80

Compu/Think announced a 800K Dual Head, Double Density mini-floppy Disk Drive for the 16K and 32K Commodore CBM micro-computer. It will also be available for the 8K PET with a minimum of 16K memory expansion.

The dual disk system features speed and 24 hour usability. On every disk read or write, a secondary verify read is automatically performed. The disk motors are automatically turned off between operations to reduce wear. Data is read or written a full track at a time to increase data access times: a 20K program can be loaded (including automatic verify and motor start up) in 3 seconds. It comes with its own controller and operating system in 4K additional ROM which plugs into the internal memory expansion board. Seventeen new commands are added to the normal Microsoft BASIC resident in the PET, and a set of machine language routines which can be combined to provide: random access; indexed sequential access; and more. Price: $1295.00 Installation time: 5 minutes.

THANKS FOR THE MEMORIES.

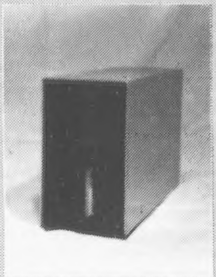
Compu/Think, 3260 Alpine Road, Menlo Park, California 94025, (415) 854-2577.

**CIRCLE 250 ON READER SERVICE CARD**

PERTEC • SHUGART • MPI

TRS-80 DISK DRIVES AT AN AFFORDABLE PRICE

INTRODUCTORY OFFER



**MPI DISK DRIVE** With Power Supply And Cabinet. Features Include Automatic Diskette Positioning And Ejection, 18% More Storage Capacity. Included With Each Unit Is A **4** Drive Cable, **Enhanced** Disk Operating System, And **1 Year** Unconditional Warranty. Available For **Immediate** Delivery. **Satisfaction Gauranteed.**

**$499**

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| MPI DISK DRIVE WITH POWER SUPPLY AND CABINET. | $385 |
| PERTEC DISK DRIVE WITH POWER SUPPLY AND CABINET. | $385 |
| SHUGART DISK DRIVE WITH POWER SUPPLY AND CABINET. | $389 |
| ENHANCED DISK OPERATING SYSTEM | $99 |
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**Heath H8 Owners....**

Want to do something useful with your H8? Drop me a line and I'll send you an abstract of goodies I presently have available in article form such as 32 channel ON/OFF controller, Selectric interface, Sound generator...

**Henry Fale**
2918 S. 7th Street
Sheboygan, WI 53081
(414) 452-4172

CIRCLE 138 ON READER SERVICE CARD

FIVE DISKLESS TRS-80 PROGRAMS:
(1) **TELEPHONE/ADDRESS/MAILING** - Name & Zip Sort. Even retrieves name from phone #. Very quick access of over 120 listings at 16K, 300 at 32K.
(2) **CHECKBOOK** - Keep up with the bank. Can 170 easily accessible listings cover a year's activity?
(3) **TAX RECORDER** - Lists your yearly tax deductible expenses. Adds all your columns, saves pencils.
(4) **FOOD FOR THE HEAD** - Nutritional contents of foods vitamins, minerals, amino acids, carbohydrates, fats, fiber, protein, calories. 16K $40, 32K $50.
(5) **MANDALAS FOR THE CYBERNECTIC AGE** - Warning: Highly hypnotic graphics. 2 Sets of 4 interweaving designs all above Level II 16K $30 or as noted.
Loweco also carries Microsoft, TSE and TBS for the TRS-80. Send $2 for catalog.

**Loweco Computer**
**1803 Rodney**
**Los Angeles, CA 90027**
**213-660-7530**

Money Order, Cashier Check speeds delivery
6% Sales tax for Californians

CIRCLE 146 ON READER SERVICE CARD

**GREAT BRITISH SOFTWARE**

TRS-80 Level II machine-code utility programs, self-relocating, any size memory.
Example: Fast Graphics $9.95

**SOUTHERN SOFTWARE,**
P.O. Box 39,
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**A.C. POWER CONTROL for ALL COMPUTERS or COMPLETE TURNKEY SYSTEMS**

**Interface TO** the **Real World** with **GIMIX Relay Driver Boards.** Connects to any Computer through a 20 ma. current loop (up to 4 Boards-128 Relays per port).

**Interface FROM** the **Real World** with **GIMIX**

- ★ OPTO BOARDS (up to 34 switch closures with one 8 bit Parallel I/O Port)
- ★ 16 BUTTON KEYPADS
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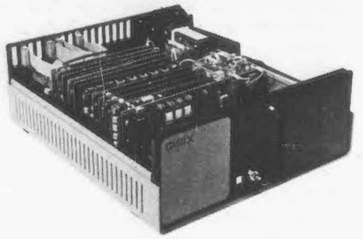
**A Broad Range of 6800 Systems and Boards Compatible with the SS50 Bus**



**MAINFRAME:** Includes chassis, power supply, switches, fan and mother board . . **$ 798.19**

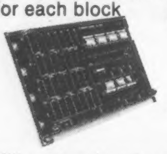
**16K SYSTEMS:** Mainframe, plus 6800 CPU, 16K Static Ram and choice of I/O . . . . **$1344.29**
Other packages available.

**16K Static RAM Boards for the SS-50 Bus**

- Gold bus connectors
- 4 separate 4K Blocks
- Individual Addressing, Write Protect, and Enable/Disable for each block

*Memories . . .*

**$\$298^{13}$**



As above with Sockets and Software control features **$\$368^{16}$**

*All GIMIX memory boards are assembled, Burnt-In for 2 weeks, and tested at 2 MHz.*
Add $32.00 for 250 ns parts

**TI TMS 4044's — 10% SUPPLY**
***(Not an "equivalent", but the real thing!)***

| | | | |
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| 450 ns | **$5.90** each | 250 ns | **$6.90** each |
| 8KPROM BOARD | | | **$ 98.34** |
| 4K PPD PROM BOARD, Burner and Duplicator | | | **198.35** |
| 2708's | | each | **7.90** |
| 64 or 32 x 16 VIDEO BOARD | | | **198.71** |
| 80 x 24 SUPER VIDEO BOARD with user programmable RAM character generator | | | **458.76** |
| Serial I/O's | 1 Port **$ 88.41** | 4 Port | **198.43** |
| Parallel I/O's | 2 Port **$ 88.42** | 8 Port | **198.45** |

Add $5. handling charge on orders under $200.

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*Quality Electronic products since 1975.*

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# PERIPHERALS

## SOFTOUCH TELEPHONE DIALER AND DISK FILE DIRECTORY FOR APPLE II

Consists of an interface card for the Apple, a Tone Module, and versatile disk software package to maintain and sort a file of addresses and phone numbers. The Softouch Tone Dialer is directed towards Apple users in business or home, to take practical advantage of computer power for routine everyday activities. Price: $89.00. Available at your local Apple computer store, or directly from Scientific MicroPrograms.

Scientific MicroPrograms, 1196 East Cunningham Drive, Palatine, ILL. 60067.

**CIRCLE 251 ON READER SERVICE CARD**

## MOUNTAIN HARDWARE'S SUPERTALKER

SuperTalker is a Mountain Hardware peripheral system which allows the Apple II computer to output high quality human speech through a loudspeaker under program control. Output may also be directed through any P.A. or stereo system. Initially, spoken words are digitized into RAM memory through the system microphone. Speech data in RAM may then be manipulated like any other stored data.

The SuperTalker system consists of the peripheral card which plugs into a pheripheral slot on the Apple II; a microphone; a loudspeaker; easy-to-use operating software and documentation; plus, two ready-to-run SuperTalker programs.

To achieve maximum utility, the SuperTalker Disk Operating System permits output of human speech under program control with direct I/O routines. It also provides a preparation program which permits the creation of voice files on diskette. BASIC program routines are provided which require only one-line statements to output a word or phrase. Price: $279 assembled and tested. Available through computer dealers worldwide.

Mountain Hardware, Inc., 300 Harvey West Blvd., Santa Cruz, CA 95060, (408) 429-8600.

**CIRCLE 252 ON READER SERVICE CARD**

## PET AUDIO SPECTRUM ANALYZER

Eventide Clockworks has produced a real time audio spectrum analyzer designed to fit inside the Commodore PET computer.

It divides the audio spectrum from 20 Hz to 20 kHz into 31 third-octave bands, and displays those bands, with their relative amplitudes, on the PET screen. The PET can store and recall spectral data, and compare them with past, future or other channel data. There is a PEAK HOLD feature, which enables the unit to determine whether any preset levels have been exceeded. Programs to access the analyzer are written in BASIC - three are provided with the unit: Interactive Operation, Self Test, and Minimal operation. $595.

Eventide Clockworks, Inc., 265 West 54th St., New York, NY 10019, (212) 581-9290.

**CIRCLE 253 ON READER SERVICE CARD**

## RS232C COMPUTER COMPATIBLE PAPER TAPE READER

Addmaster Corporation announces that the Model 612 Stand Alone Paper Tape Reader is available from stock and is shipped in 1 to 3 working days after receipt of order. The Model 612 has ability to read 5 to 8-level tape and to transmit 7 to 11 frames per character at 50 to 9600 baud. Others include starting and stopping on character at all speeds,

choice of manual control or X-on, X-off, 90 to 260 volt, 50 to 60 Hz power and even, odd or no parity. RS232, current loop or parallel outputs are available as is a choice of desk top or rack mounting. Single unit price: $625.00 to $761.00.

Addmaster Corporation, 416 Junipero Serra Drive, San Gabriel, California 91776, (213) 285-1121.

**CIRCLE 254 ON READER SERVICE CARD**

# MAGAZINES, JOURNALS

## BRIDGE

Bridge is a newsletter published by the Digital Group Independent User's Group. A typical issue, about 24 pages long, contains programs, bug fixes, information on new products, classifieds, letters and miscellaneous hints and tips. Must reading for owners of Digital Group computers. $6.00 for six issues.

Digital Group Independent Users Group, P.O. Box 316, Woodmere, NY 11598.

**CIRCLE 255 ON READER SERVICE CARD**

## BUSINESS COMPUTING PUBLICATIONS

BusinessComputing Press has announced a series of publications informing businessmen and professionals about the effective utilization of lowcost microcomputers in their business. The publications are: the bimonthly journal, BusinessComputing Review ($25, annually); the report, "Evaluating Small Business Software" ($15); and BusinessComputing Newsletter, published six times annually (free).

Business Computing Press, P.O. Box 55056, Valencia, CA 91355.

**CIRCLE 256 ON READER SERVICE CARD**

## GRAPHICS NEWSLETTER

The Harvard Newsletter on Computer Graphics will keep abreast of computer graphics. The newsletter will monitor important commercial, technological, and product developments, as well as market, application, application, and learning opportunities. Among the regular departments will be News and Trends, Products, Markets, Applications, R & D, Conferences and Seminars, Companies, Business and Financial, and State-of-the-Art Technology. 1 yr. (24 issues), $125; 9-issue trial, $45; for airmail outside of North America, add $19.50 or $9.75 for the trial.

Harvard University, Laboratory for Computer Graphics, 520 Gund Hall, Cambridge, MA 02138, (617) 495-2526.

**CIRCLE 257 ON READER SERVICE CARD**

**apple tv & computing**

2606 South Robertson Blvd
LOS ANGELES, CALIFORNIA 90034
(213) 559-4268

**PET MEANS BUSINESS!!**

The new COMMODORE CBM with Intelligent Dual Minifloppy and Tractor impact printer is taking the lead in its price class!

CBM WORD PROCESSOR

is a FULL FEATURE Direct Cursor Editor, with features like auto repeat, auto insert and delete, global search and find, scrolling, full justification.

It's superfast formatter and output section gives you capabilities of tremendous throughput at lower cost!

Couple one to our Centronics 753 printer and you have 130 to 150 CPS!!

Also available for the CBM:
GEN'L LEDGER, A/P-A/R, PAYROLL
Based on Osborne & Assoc. books, these are well documented, efficient programs. $125 per Module, or... only $350 complete pack.

MasterCharge, Visa Welcome

**CIRCLE 109 ON READER SERVICE CARD**

**MICROPOLIS**

**CCA DATA MANAGEMENT SYSTEM HIGH SPEED SORT**

This high speed Mach. Lang. Sort allows Creative Computer Application's DMS sort and merge to run in at least half the normal time (depending on the file length and sort key size). This program is designed to be used with the DMS programs. It is very easily interfaced.

ALSO AVAILABLE: a machine Language Sort Utility. The utility is designed to be easily interfaced to **YOUR** BASIC programs. The sort is 100 times faster than the best written BASIC sort. We also offer a Mach. Lang. Mailing Label Program. To sort the maximum 1000 records requires 15 seconds. The output options allow for sorting by the last name or company name, zip code, and a user defined variable.

| | |
|---|---|
| **COMPLETE USERS MANUAL** | **$10.00** |
| **MAILING LABEL (ML)** | **79.50** |
| **MAILING LABEL (BL)** | **39.50** |
| **MACH. SORT UTILITY** | **59.50** |
| **DMS SORT PACKAGE** | **69.50** |

Available to be shipped immediately upon receipt of your order and payment (money order, cashier's check, Visa or Master Charge). A shipping charge of $2.00 will be added to all orders. California residents, please add 6%. Please indicate Basic 3.0 or 4.0 Ver. and memory size.

**COMPUTER SERVICES**
P. O. Box 81243
San Diego, CA 92138
(714) 438-9137

**CIRCLE 126 ON READER SERVICE CARD**

**CP/M←→IBM**

**Compatability with**

***REFORMATTER***™

For $200 you can now transfer data between big and small systems.

*REFORMATTER*, a Diskette Utility Program, enables you now to transfer textual data files in either direction between Z-80 or 8080 based micros operating under CP/M and IBM systems using 3741 diskettes or systems accepting input data through conversion from the IBM 3741 diskette.

Detailed program information available from:

**MicroTech Exports**
**912 Cowper Street**
**Palo Alto, CA 94301**
**Tel: 415/328-1712**

**CIRCLE 157 ON READER SERVICE CARD**

# BOOKS AND BOOKLETS

## SPACE WARP

Search from one end of the galaxy to the next and your sensors won't detect a better illustrated space fantasy than SPACE WARP, the first color storybook of its kind published by Troubador Press.

Galaxy T-42's inhabitants bask in a paradise of beauty and joy. From high above sounds an evil laugh: "Chaos is my comfort!" The renegade Baron Zax and his savage star raiders threaten to subjugate entire solar systems. Against this scourge stands SPACE WARP, the immense, computerized, laser-wielding monitor of truth and harmony. A cosmic battle ensues, its startling skirmishes narrated at a rocketing pace.

Written by Frank Fox and illustrated by Larry Evans this 32-page large format book ($2.50) can be found at book, gift, and museum shops everywhere.

Troubador Press, 385 Fremont, San Francisco, CA 94105, (415) 397-3716.

## INTELLIGENT COMPUTER PRODUCT REPORT

"Intelligent Computer Products - Technology Applications and Market Opportunity," a new 250 page report is available from Electronic Trend Publications. This report addresses the latest developments in micro-electronics and the opportunity to create a variety of individually used and generally hand held products for the industrial and consumer markets. Contained in the report are innovative examples of currently available individual-use microcomputer products such as inventory takers, analytic and test instruments, language translators, telephone products as well as examples from the numerous consumer products. $575.

Electronic Trend Publications, 10080 N. Wolfe Road, Cupertino, CA 95014, (408) 996-7400.

**CIRCLE 258 ON READER SERVICE CARD**

## SMALL BUSINESS SYSTEMS

Management Information Corporation has introduced the second publication in their "Pathways Through Data Processing" series, reports designed to educate businesspeople in the complexities of data processing. "Pathways Through Data Processing: Small Business Systems" describes the most dynamic part of data processing: small business computer systems. Included in this 200-page report is a complete description of a small business system, in terms of terminals, computers, peripherals, system software, and data communications. $55.

MIC, 140 Barclay Center, Cherry Hill, NJ 08034.

## DP MANAGEMENT REPORT

Data Management magazine is offering a 32-page Information Executive's Report. It contains eleven original articles, written by experts in the field of office automation, data processing, word processing, productivity, micrographics and modern management techniques. There also is a "buying guide" listing 75 vendors, their product lines and addresses. $1.25 prepaid.

DPMA, 505 Busse Highway, Park Ridge, IL 60068.

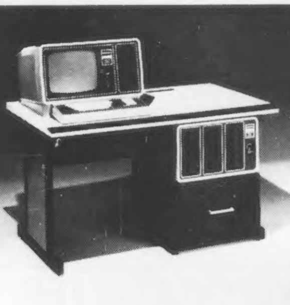
**CIRCLE 259 ON READER SERVICE CARD**

## COMPUTER OPERATIONS GUIDE

Management Information Corporation has announced a series of reports, "Computer Operations Guide," designed to help in the effective management of the data processing installation. The first in this series, "Evaluating Your System," is a do-it-yourself kit for analyzing and quantitatively rating the effectiveness of any size data processing installation. This report permits a company to perform an evaluation utilizing their personnel and thereby saving consulting costs. $65 until August 31; after $75.

MIC, 140 Barclay Center, Cherry Hill, NJ 08034, (609) 428-1020.

**CIRLCE 260 ON READER SERVICE CARD**



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**10 Enter data in form below**

**20 Goto mailbox**

**30 Mail form**

**40 Recieve the Personal Computer Catalog**

**50 End Well Done!**

Follow this simple program and you will receive The Personal Computer Catalog. The one reference book to fine quality personal computers, software, supplies and accessories

This valuable catalog is FREE so mail your order today.

Name ____________

Address ____________ State ____ Zip ____

City ____________

Do you own a computer? ______ What type? ______

Do you use your computer for: Business? ______

Personal? ______ Education? ______ Other? ______

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SERVING THE PERSONAL COMPUTER INDUSTRY

Or phone: (612) 884-1475

Weldon Electronics
4150 Hillcrest Road
Wayzata, MN 55391

**CIRCLE 188 ON READER SERVICE CARD**

## TOOLS

### PEAK-READING MONITOR FOR CASSETE

PK-80
PEAK READING VM

The PK-80 peak reading VM reads cassette output on a bi-polarity basis. Based on a battery operated dual op-amp, the meter can eliminate uncertainties associated with loading program and data from cassette. The PK-80 also provides means for restoring the cassette deck head azimuth. $49.50.

Cook Laboratories, Inc., 375 Ely Avenue, Norwalk, CT 06854.

**CIRCLE 261 ON READER SERVICE CARD**

### CSC CATALOG

1979
CSC
CONTINENTAL SPECIALTIES CORPORATION

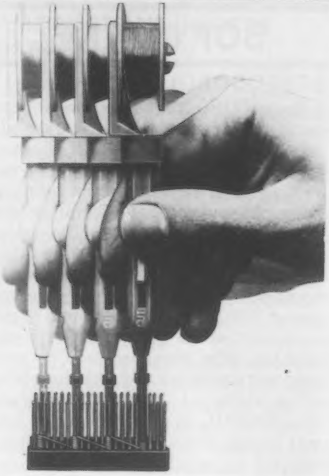
Continental Specialties Corporation's new 32-page catalog, entitled "1979 CSC," features the company's signal generators, electronic test instruments, logic probes, frequency counters, solderles breadboards, digital troubleshooting instruments, IC test clips, the Probe Case, the Handheld Case, the Portable Case, the Benchtopper Case and the Experimentor System. Free.

Continental Specialties Corporation, 70 Fulton Terrace, New Haven, CT 06509, (203) 624-3103, West Coast: 351 California St., San Francisco, CA 94104, (415) 421-8872.

**CIRCLE 262 ON READER SERVICE CARD**

### O.K. INTRODUCES WIRING TOOL

O.K. Machine and Tool Corporation (New York) has announced "Just Wrap" a wiring process and a series of tools that produce wire wrapped connections without prior stripping or sliting of the wire insulation. Designed to wrap on .025 in. (0,63mm) sq. posts, each tool carries a 50 ft. (15m) spool of 30 AWG (0,25mm) wire. It will wire continuously through any number of pins (daisy chain). Equipped with a built-in wire cutoff, it is suited for point-to-point wiring. Wire available in 4 colors: blue, white, red and yellow. $14.95; refill spools $2.98. Thru local distributors.



O.K. Machine and Tool Corporation, 3455 Conner Street, Bronx, New York 10475.

**CIRCLE 263 ON READER SERVICE CARD**

MAGIC WAND™
Word Processing System

the most powerful, most flexible word processing software ever written for a CP/M*-based computer.

We could spend our entire time talking about features and you might not realize the revolution that the MAGIC WAND represents. Because the MAGIC WAND isn't just a set of programs, it's a complete, integrated package.

Don't get us wrong. We have created an extremely flexible text editor and processor that can do things no other system can, without having sacrificed simplicity or ease of use.

*But that's only half the story.*

The other half is what we do for the user. We have written our user's manual in English that you can understand even if you don't have a Ph.D. in computer sciences.

The manual includes a step-by-step instructional program that utilizes sample files included on the system disk so that you get hands-on experience while you learn.

For everyday use there is a handy reference card with a thumbnail description of commands and control key functions.

In short, we've done everything we can to make things easy for you. Because the most sophisticated software in the world is just a bunch of code if you can't use it.

THE STATE OF THE ART HAS CHANGED.

small business applications, inc.
3220 Louisiana • Suite 205 Houston, Texas 77006
*CP/M is a trademark of Digital Research Corp.

CIRCLE 204 ON READER SERVICE CARD

STOCK MARKET • TRADER
ENTREPRENEUR

OPTION ANALYSIS SYSTEM
This system in strictly for the market speculator. Working with price, calculated volatility, and calculated average daily premium, this system picks the best buys from 75 or more options. Judgement by the analyst is required. For $35.00 you receive two programs plus example data base and instruction manual. TRS 80 LEVEL II and PET

STOCK MARKET ANALYSIS SYSTEM
Technical analysis, 12 daily and 15 weekly indicators, for the stock market enthusiast. This system signaled the Oct. 78 debacle. For $25.00 you receive two programs plus data base and 27 page detailed instruction manual.
TRS 80 LEVEL I or II 16K and PET

FINANCIAL ANALYSIS SYSTEM
Includes two programs and hard copy instructions for better control of your stock and option transaction. For $20.00 you receive software with eight analysis routines. Two of these routines are stock transactions which made money and option transactions which made money. Six more program routines exist with some consideration given to taxes. Please indicate:
TRS 80 LEVEL II 16K or PET 8K

ACCOUNTING ANALYSIS SYSTEM
Includes two programs and hard copy instructions for a small cash enterprise. From your data base a Profit and Loss Statement as well as a Balance Sheet are produced. In addition simple budget comparisons are made. Please remit $20.00 and indicate:
TRS 80 LEVEL II 16K or PET 8K

LETTER PROCESSER
This program for TRS 80 owners with printers. Generates letters to different individuals with the same body. Cassette file stores names and addresses. Remit $15.00.

Distributed by: STEVEN E. SHAW, P.E.
P.O. Box 1707
Tampa, Florida 33601

CIRCLE 197 ON READER SERVICE CARD

# SOFTWARE

## SPEEDCOBOL

SpeedCOBOL is a preprocessor which converts code written in shorthand into output acceptable to an ANSI standard COBOL compiler. This makes program writing and keying much quicker by using abbreviations for commonly used keywords and variables. The program requires about 50K of memory and is itself written in COBOL, so that user modifications and enhancements to SpeedCOBOL are possible and it can be implemented on any COBOL speaking machine. The preprocesor also outputs program statistics and has the ability to define different kinds of translations. SpeedCOBOL is available on a permanent license basis for $5000. A thirty-day free trial is available.

Foundation for Software Engineering, 81-27 88th St., Glendale, NY 11227, (121) 846-3594.

**CIRCLE 264 ON READER SERVICE CARD**

## TINY PASCAL FOR TRS-80

Your TRS-80 can run Pascal too. The Chung/Yuen 'Tiny' Pascal is fully implemented for your TRS-80 (Level II, 16K). It gives you everything you need to write structured Pascal programs: the Tiny Pascal compiler; a complete text editor for writing your programs; a complete 'Tiny' Pascal monitor; sample Pascal programs; and a user's manual.

'Tiny' Pascal is both a powerful, structured language and very fast. Your 'Tiny' Pascal programs will execute at least 4 times faster than basic, and often 8 times faster! We have also given you special functions to make complete use of the graphic capability of your computer. When you combine the speed of Pascal and the graphics, you now have the means to write those dazzling, impressive, high speed graphics programs that are great for games, plotting, statistics, etc.

For the serious hobbyist, side two of the 'Tiny' Pascal cassette tape contains a larger compiler and complete source to the compiler written in Pascal. This means you can re-compile the compiler, making changes, adding features, etc. (But this will take at least 36K RAM and a good solid knowledge of programming.)

The operating system supplied with 'Tiny' Pascal for TRS-80 is complete. You can save and load both source programs and compiled programs to or from cassette tape. Once you have a fully de-bugged program, you can save the P-code (the compiled program) and thereafter, to run the program you need only load the P-code.

'Tiny Pascal features include: recursive procedure/functions for (loop) case; if/then/else; one dimensional arrays; write; read; constant; repeat/until (loop); "Peek & Poke" and plot (graphics for TRS-80).

You will also receive a complete users' manual with step by step instructions on how to use 'Tiny' Pascal. The cost of 'Tiny' Pascal is $40.00.

Supersoft, P.O. Box 1628, Champaign, IL 61820, (217) 344-7596.

**CIRCLE 265 ON READER SERVICE CARD**

## CRS—CLIENT RECORD SYSTEM

CRS is a program package designed to meet the needs of the insurance agent. With CRS the agent will be able to keep up to the minute tabs on all his clients. CRS is also a very powerful marketing tool, allowing the agent to execute a powerful 'sieve' search of the client records and perform statistical analysis of them.

CRS also provides complete on-line access of client records and the printing of sorted mailing labels by any field. CRS stores name and address, as well as complete policy information for up 1500 clients in a dual drive system.

CRS is fully compatible with the Northstar disc system and is supplied with two users manuals: one for the owner, and the other is a 'quick start' manual for use by office personnel. CRS has been completely tested under the most demanding of environments.

The price for CRS is $250.00.

Supersoft, P.O. Box 1628, Champaign, IL 61820, (217) 344-7596.

**CIRCLE 266 ON READER SERVICE CARD**

TORA SYSTEMS INC.

Call about our fantastic price on 4-drive complete system.

| | |
|---|---|
| Level II-16K (w/o num. keypad) | $750.00 |
| Expansion Interface 0 | $269.00 |
| Expansion Interface 16K | $423.00 |
| Expansion Interface 32K | $592.00 |
| 16K Memory Kit for TRS-80 or Apple | |

TRS-80 & NORTH STAR ADD-ON DRIVES

CUSTOM CABLE

ENCLOSURE INCLUDED

| | |
|---|---|
| Shugart SA 400 or BASF 6106 single drive system in custom enclosure. | $415.00 |
| Double drive system in custom enclosure. | $850.00 |
| BASF 6106 40 track, drive only. | $299.00 |
| Shugart SA 400. | $315.00 |
| Seaman 8" drive. | $399.00 |
| HAZELTINE 1400, WHILE SUPPLY LASTS! (18 MONTH WARRANTY). | $1049.95 |
| Centronics P1 printer (TRS-80 add-on). | $398.95 |
| Centronics 779-2 tractor (TRS-80 add-on). | $1049.95 |
| TI printer. | $1599.00 |
| Horizon 1 Kit. | $1339.00 |
| Single tier walnut Formica enclosure for SA 400 or BASF drive. | $27.00 |
| Two tier walnut enclosure for SA 400 or BASF drive. | $45.50 |
| Verbatim mini disks, 5-1/4", box of 10. | $3.20 per disk |
| Box of 10, 8" disks. | $3.95 per disk |

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TARBELL VDS-II
Vertical Disk Subsystem

SYSTEM INCLUDES:
- 2 Siemens 8" Disk Drives
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- 1 Tarbell Floppy Disk Interface, assembled & tested.
- 1 CP/M* Disk Operating System.
- 1 Tarbell BASIC.
- All Cables and Connectors.
- Complete User Documentation.
- Fully Factory Assembled and Tested.

Price . . . . . . . . . . . . . . . . . . . . $1888.00

*CP/M is a product of Digital Research Corp.*

TARBELL BASIC

Tarbell Electronics
950 DOVLEN PLACE, SUITE B
CARSON, CA 90746
(213) 538-4251 • (213) 538-2254

CIRCLE 185 ON READER SERVICE CARD

## FORM LETTER MAIL LIST AND FORM LETTER GENERATOR

'Form Letter' is a system of programs for generating, maintaining and printing multiple form letters and mailing lists.

'Form Letter' features: Form--a simple text generator for entering and verifying (via hardcopy or CRT display) plain English text;address--similar to Form but structured for address data entry; Search--a program used for finding a particular address record based on all or part of the name, city, state, zip or client account number. Selected records are written to a printer or disk file based on whether the key portion of the record is equal to, less than, greater than or not equal to the user supplied sample; Sort--a high speed, multiple key sorting program using C.A.R. Hoare's algorithm; and Letter--a single or multiple form letter output program. Letter merges the desired text file with the appropriate, user selected address file to produce a finished business letter.

'Form Letter' is written in CBASIC2* and requires a minimum of 32K of ram and a Disk Operating System with one disk drive (two drives required for optimum performance). 'Form Letter' is available for $275.00.

T. M. Systems, 73 Baker Ave., Dover, NJ 07801, (201) 361-4558.

*CBASIC2 is a product of Structured Systems Group Inc., Oakland, California

**CIRCLE 267 ON READER SERVICE CARD**

## COMPILER FOR INTEL 8080

A full C compiler for the Intel 8080 microcomputer is available from Whitesmiths, Ltd. A complete set of runtime support routines, the Whitesmiths Portable C Library, an interface library for operation of C under either CP/M for ISIS-II and a translator for the narrative assembly language A-Natural accompany the compiler.

It is currently available as a cross-compiler running on the PDP-11 under UNIX, RSX-11M, RT-11, RSTS/E, and IAS. Operating in three sequential passes, it produces A-Natural code, which is then translated to assembly language that is compatible with Intel's asm80 and Microsoft's Macro-80. A standard package is available for $700 per binary CPU license. Including the C compiler and PDP-11 support package, the A-Natural translator, and the runtime library for use on a single 8080. Use of the minimal machine interface library on additional microcomputers is available for as little as $10 per CPU, in small quantities.

Whitesmiths, Ltd. offers training in the language C, maintenance for all of its software products, and licenses for source code and internals documentation. A catalogue of all goods and services may be obtained by writing:

Whitesmiths, Ltd., 127 East 59th Street, New York, N.Y. 10022.

**CIRCLE 268 ON READER SERVICE CARD**

## MICROSOFT ANNOUNCES 8086 BASIC

Microsoft BASIC, is now released in a version for the 8086 16-bit microprocessor. "BASIC-86" supports all the well-known commercial language features.

Demonstrated at NCC on Seattle Computer Products' 8086 CPU board for S-100 bus microcomputers, BASIC-86 was shown to be language-compatible with the current release 5.0 of standard Microsoft 8080 BASIC. This means users of Microsoft 8080 BASIC can upgrade to an 8086 microprocessor without modifying existing programs.

BASIC-86 supports newly-added features including WHILE/WEND, CHAIN and COMMON statements to link programs and share variables, dynamic string space allocation, and variable names up to 40 characters in length. It meets all the qualifications for the ANSI subset standard for BASIC.

Available in two versions: Extended and Standalone Disk Version, both for Intel SBC 86/12. Single copy prices: $350/Extended and $600/Disk. Dealer and OEM prices quoted on request.

Microsoft, 10800 NE 8th, Suite 819, Bellevue, WA 98004, (206) 455-8080 Telex: 328945.

**CIRCLE 269 ON READER SERVICE CARD**

have a
HAPPY
day!

• PET • PET • PET • PET • PET • PET • PET • PET • PET • PET • PET • PET • PET • PET

PET PRODUCTS

Programs — Workbooks
for Floppy Disk — for Cassette

Dealer
Inquiries
Invited
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Put your PET to work!

T I S

PROGRAMS

| | |
|---|---|
| SW-1* | **MAILB** mailing list system |
| SW-2* | **CHECKBOOK** record |
| SW-3* | **ACCOUNTS** keep track of who owes you how much |
| SW-4 | **MEDIT** create and maintain data files |
| SW-5* | **CALENDAR** appointments, meetings at a glance |

WORKBOOKS

| | | |
|---|---|---|
| WB-1 | **Getting Started with Your PET** | $3 95 |
| WB-2 | **PET String and Array Handling** | $3 95 |
| WB-3 | **PET Graphics** | $4 95 |
| WB-4 | **PET Cassette I/O** | $4 95 |
| WB-5 | **Miscellaneous PET Features** | $3 95 |
| WB-6 | **PET Control and Logic** | $3 95 |

*These programs are special purpose data base management systems They all can

- Sort numeric or string fields
- Select based on numeric or string (=)
- Select based on substring match
- Select based on range of entry number

Prices: $9.90 each for programs using cassette storage for data
$12.95 each using sequential floppy disk storage for data.
$5.95 each for instruction manual, approximately 40 pages.

Add $1 50 for shipping and handling

Money back guarantee

TIS
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Los Alamos, NM 87544

PET is a trademark of Commodore Business Machines

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CIRCLE 187 ON READER SERVICE CARD

SUPER SPECIAL

Apple II 16K

$999.99

| | |
|---|---|
| (8) 16K Rams | $65.00 |
| (10) Verbatim Disks | $27.00 |
| Axiom 820 Microplotter | $699.99 |

INTRODUCTORY OFFER

TEXAS INSTRUMENTS

TI 99/4

16K ........................ $1099

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Tues.—Sat.
11:30 to 6 PM

CIRCLE 192 ON READER SERVICE CARD

# SOFTWARE

## NEW SYSTEMS FOR TRS-80

TBS Inc. announced System Doctor, a utility program for the TRS-80. Requiring 16K or more, it does a diagnostic check of the entire computer system. It checks ROM, RAM, video memory and display, disk drives, cassette recorders speed, volume and distortion and printer functions. Price: $28.50.

Checkbook II requires 16K or more, and does everything necessary to keep your checkbook balanced. It prints on screen in five columns and can handle amounts up to $1,000,000. Checkbook II does a complete checkbook balance and reconcile. The 16K version allows only tape files and the 32K and 48K version allows disk or cassette files. Price: $18.50.

Information System requires at least 16K. It is an in-mem data base manager and is operator programmable. Up to ten fields are allowed with up to 40 characters per field and up to 200 characters total per record. In-mem creates either disk or tape files. Complete editing mode is provided allowing changes by line instead of entire record. It allows you to program your own printouts to any format you desire, to accomodate rolodex cards, summary listings and etc. It is ideal for small mailing lists, inventories or anything you would file with index cards. Price: $24.50.

BASIC Toolkit aids in basic language programming. It provides variables map, GOTO X REF, RECALL, MERGE, TEST MEMORY and SEARCH MEMORY. It works with both disk and cassette based machines, 16, 31 or 48K. Price: $19.80.

Business Mailing System is designed for large scale business users with at least 32K of memory, a printer and two disk drives. It will allow the user to store up to 150,000 names on a single large file composed of multiple diskettes. Entries are sorted into zip code and alphabetical order within the zip code. The file will grow up to 300 diskettes, and each diskette holds 500 names.

For large scale mailing lists, Price: $125.00.

The Bottom Shelf, Inc., P.O. Box 49104, Atlanta, Georgia 30359, (404) 938-3304.

CIRCLE 270 ON READER SERVICE CARD

## ENTERTAINING AND EDUCATIONAL SOFTWARE FROM PDI

**Memory Builder, Story Builder** and **Code Breaker** are 3 educational games from Program Design, Inc. for the Apple, PET, or TRS-80 Level II.

**Memory Builder** a Concentration-type game that helps kids improve memory and attention span. **Story Builder** writes short stories with the child to help improve grammar and vocabulary. **Code Breaker** (not available for TRS-80) gives scrambled messages for players to decode: improves basic writing skills. All are $13.50. **Morse Code Game** is for the PET only. It turns the PET into a Morse Code sounder and gives players practice in decoding messages. Comes with plug for computer; user supplies a 6-volt buzzer. Price: $14.95. **Minicrossword** (for the TRS-80 Level II and Apple II) forms minicrossword puzzles. Dozens of different puzzles are possible. The computer gives clues and scores you on how well you do. Two (2) crossword games and 2 Codeword puzzles are on the tape. The 4 programs together help improve vocabulary and spelling skills. Price: $14.95. **Spelling Builder** is for high school students and adults who have mastered basic spelling but still have trouble deciding whether it's "digestable" or "digestible," "supersede" or "supercede" etc. Not just drill, this series of programs actually teaches you how to handle difficult words. Contains a computer tape and an audio tape. Price: $18.50. Available for TRS-80 Level II and Apple. All tapes guaranteed to run.

Program Design, Inc., 11 Idar Court, Greenwich, Conn. 06830, (203) 661-8799.

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CP/M®2

CONTROL PROGRAM FOR MICROCOMPUTERS

**NOW BETTER THAN EVER.**

You've probably heard about CP/M. But if you haven't, it's the world's most popular operating system. CP/M is considered the "software bus" for 8080 and Z80 microcomputers because it gives you the hardware-independent interface you need to make your computer work for you. Because it's hardware-independent, you can get programming languages, word processing software, and business applications packages from scores of suppliers at affordable prices.

CP/M 2.0 is the latest in the evolution of a proven reliable and efficient software system. It's the kind of reliability that comes from five years of field testing in thousands of installations. And it's supported by an experienced staff dedicated to maintaining CP/M as the best product in the industry.

CP/M 2.0 gives you many new features, with an enhanced upward compatible file system, powerful new random access capabilities, and unprecedented field alteration facilities which allow you to tailor CP/M 2.0 to manage virtually any disk subsystem. From minidisks, floppy disks, all the way to high-capacity hard disks, the flexibility of CP/M 2.0 makes it a truly universal operating system. Get yourself or your company on the software bus: contact us for further details, or ask your dealer about CP/M 2.0 availability for your computer.

DISKETTE and DOCUMENTATION
Single Quantity Prices: $150

MP/M™

MULTI-PROGRAMMING MONITOR

**NEW INDUSTRY STANDARD**

Digital Research announces a deluxe operating system that provides big computer facilities at small computer prices. MP/M is a monitor program which operates with your microcomputer to provide multi-terminal access with multiprogramming at each terminal. Best of all, it's CP/M compatible which means you can run a wide variety of programming languages, applications packages, and development software.

If you want, you can run simultaneous editors, program translators, and background printer spoolers. Or you can use MP/M for data entry or data-base access from remote terminals. Or you can use MP/M real-time features to monitor an assembly line and automatically schedule programs for execution throughout the day. MP/M makes an excellent focal point for a cluster of connected microcomputers. The possibilities are limitless.

Like CP/M, MP/M is especially built to adapt to most 8080 or Z80 microcomputers, with an 8086 version on the way. You can operate your I/O devices either interrupt-driven or polled, and you can even write your own system processes which are combined with MP/M through a simple system generation. It's an exciting new product from the most experienced systems software supplier in the microcomputer industry. Contact us for details, or ask your dealer about MP/M availability for your computer system.

DISKETTE and DOCUMENTATION
Single Quantity Price: $300

DIGITAL RESEARCH Post Office Box 579 Pacific Grove, Calif. 93950 (408) 649-3896

CIRCLE 136 ON READER SERVICE CARD

## COMPUTER HOOK-UPS

CompuServe Incorporated is introducing MicroNET.

MicroNET merges the power and capabilities of CompuServe's large main frame computer systems with the smaller personal computer systems used in homes and businesses. The service enables customers to use CompuServe's Personal Computing Division computer system in Columbus, Ohio, from 25 major metropolitan areas in the U.S., by connecting their personal computers through local telephone systems. Users can communicate nationwide through a "community bulletin board" and expand the potential of their systems; create, edit and store database files, use a library of programs and sell personally-authored programs to other customers.

It requires the addition of an interface unit, called a "modem," which allows a customer's personal computer to communicate properly with CompuServe's computer, and the use of a telephone. Payment is through Mastercharge or Visa bank cards.

CompuServe, Personal Computing Division, 5000 Arlington Centre Blvd., Columbus, Ohio 43220, (614) 457-8600.

CIRCLE 272 ON READER SERVICE CARD

## LIFEBOAT'S COMPILER OFFERINGS

Lifeboat Associates offers two new compilers for CP/M*-based microcomputer systems: C Compiler - Supports most major features of the "C" language including structures, arrays, pointers, recursive function evaluation. Linkable with library to 8080 binary output. Lacks data initialization, long and float type, and static and register class specifiers. "C" Programming Language, the Kernighan & Ritchie book, included with documentation. $110 ($15 for manual alone) BASIC Compiler - Compatible with Version 5 Microsoft ANSI BASIC interpreter with 3 to 10 times faster execution. Produces standard Microsoft relocatable binary output. Supplied with Macro Assembler which produces compatible linkable modules. In addition, ANSI COBOL and ANSI FORTRAN compilers which generate compatible load modules are also supplied. $350. ($25 for manual alone).

Lifeboat Associates, 2248 Broadway, New York, N.Y. 10024, (212) 580-0082.

CIRCLE 273 ON READER SERVICE CARD

## TWO SYSTEMS FROM DIGITAL RESEARCH

Digital Research announces two new operating systems - CP/M 2.0 and MP/M. Both are adaptable to nearly any 8080 or Z80 computer system with disk backup storage.

CP/M 2.0 is an enhanced version of CP/M, release 1, and maintains upward compatibility. Standard operating system utilities are supplied with CP/M 2.0, with application packages, language processors and development systems available from independent software suppliers.

MP/M is a CP/M compatible multiterminal operating system which supports real-time multiprogramming at each terminal, along with background and foreground modes. It can serve as a complete program development environment for one or more users, or as the nucleus of clustered terminals or processors accessing a common data base. It operates currently with 8080 or Z80 microprocessors, and will be available for the 8086 processor soon.

Single copy prices: $150 for CP/M 2.0, $300 for MP/M, including documentation and diskette in single density 8" form.

Digital Research, Box 579, Pacific Grove, CA 93950, (408) 649-3896.

CIRCLE 274 ON READER SERVICE CARD

## STATISTICAL PACKAGE FOR APPLE II

Charles Mann & Associates released a statistical program package for Apple II featuring full use of the it's graphics capabilities. The package includes its own Scientific Data Management System (also available separately) and programs for curve fitting, probability, general statistics, distribution mathematics and test statistics. A built-in data base is included to produce a complete set of working examples useful in learning statistical principles. Also included are standard resolution plots for appropriate histograms and distribution arrays. Probability elements include analysis for permutations, combinations and factorials. Random number generator routines include elements for random number tables, random numbers within intervals or one-by-one for game theory. Distributions include Binomial, Poisson, Normal, Chi-Square and Student T-Distribution. Distribution probabilities may be estimated above or below a point, or outside a outside a symmetric interval, inside or outside a defined interval.

It requires 32K of RAM and at least one Disk II, and can handle up to 5 100 x 1 matricies containing raw data, grouped data or frequency arrays. A quick reference chart of legal variables is included.

Available from dealers worldwide for $89.95. Scientific Data Management System sells separately for $49.95.

Charles Mann & Associates, Micro Software Division, 7594 San Remo Trail, Yucca Valley, CA 92284, (714) 365-9718.

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KIM-1 $159 (Add $30 for Power Supply) SYM-1 $222.00

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|---|---|
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| 2114 L 450 ns 5.90 24/5.15 | 100/4.45 |
| 2716 EPROM (5 Volt) | 42.00 |
| 6550 RAM *(for 8K PET)* | 12.70 |
| 6502 Microprocessor Chip | 9.75 |
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| 6520 PIA | 5.50 |
| PET 4 Voice Music Board (MTUK-1002-2) | $ 44.90 |
| Music Software (K-1002-3C) for PET | $ 16.90 |
| Programmers Toolkit - PET ROM Utilities | $ 45.00 |
| Microchess 2.0 for PET or APPLE | 17.90 |
| PET Word Processor - Machine Language | 24.00 |
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| INTERTUBE II Smart Terminal | $ 995 | $ 780 |
| TRS-80 to S-100 HUH Kit | $ 295 | $ 260 |
| Assembled & tested | $ 375 | $ 350 |
| HUH MINI 8100 Kit | $ 115 | $ 103 |
| Assembled & tested | $ 155 | $ 139 |
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CIRCLE 122 ON READER SERVICE CARD

North Star Doc

DOCUMENTATION
- Prints formatted program listings (user selected spacing, titling, dating, and automatic paging)
- Prints cross reference table of all program variables
- Prints cross reference table of all 'GOTO' type statments

OPTIMIZATION
- Concatenates short lines into multiple statement lines of user selected length (Max=255 chars/line)

*SPEED*
- Faster execution of 'GOTO' type statements (up to 75% reduction in the number of lines of coding allows basic to locate the destination of a 'GOTO' type statement faster)
- Fast effecient subroutine to implement 'GOTO N' type statement

*SIZE*
- Typically reduces program size by 35%
- Removes all blanks not enclosed in quotes
- Optionally removes all REM statements except thsoe that are the target of a 'GOTO' type statement
- Saves three bytes for every statement concatenated

CONFIDENTIALITY
- Optionally inhibits the correct functioning of the North Star Basic 'list' and 'edit' commands if the user specified line length exceeds 132 chars/line

**DOC runs on release 4 or 5 of North Star Basic, single or double density drives. Minimum of 32K memory required. $59.00 price includes diskette and instructional manual. Order your copy from:**

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**P.O. Box 15587**
**Salt Lake City, Utah 84115**
**PH: (801) 467-1571**

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### PROGRAM SIMULATES SOLAR HOME

Sunsim-1 program calculates energy from the sun, and shows how it can be used in the home. It calculates the sun's energy in hourly intervals at any specified location on earth, and demonstrates its use for domestic space heating, cooling, and hot water heating. The system is shown with graphics. Cumulative energy and temperature values are displayed, including solar energy collected and used, backup energy used, thermal and hot water storage temperatures, etc. Users can also input their own requirements for size of home, volume of thermal storage and area and angle of solar collector. Written in TRS-80 Level II Basic, Sunsim-1 requires 16K bytes of storage. On cassette for $49 (quantity discount prices on request) Solartek, P.O.

Solartek, P.O. Box 298, Guilderland, New York 12084.

**CIRCLE 276 ON READER SERVICE CARD**

### TRS-80 DISK OPERATING SYSTEM

Microcomputer Technology, Inc. announced Disk Operating System, DOS+ available in 35 or 40 track versions.

The MTI/APPARAT DOS+ will enable any program to execute all TRS-80 commands. It also works with assembler language programs or high level languages that use DOS routines for character input and output. It comes with manual, diskette and the best of APPARAT's disk utility programs for $99 for the 35 track version, and $110 for the 40 track version.

Microcomputer Technology, Inc. 2080 S. Grand Ave., Santa Ana, CA 92705 (714) 979-9923.

**CIRCLE 277 ON READER SERVICE CARD**

### HARDCOPY GRAPHICS PROGRAM FOR THE PET COMPUTER

West Coast Consultants announces software which provides users with full graphics capability for Houston Instrument's HIPLOT plotter. The program is currently available on tape cassette for the PET computer and drives the plotter through a RS-232 interface. Although the plotter retails for $1085, the program costs just $50. The program is written in BASIC and offers sophisticated plot control to the user by means of several subroutines. The minimum memory requirements is 16K bytes. Similar programs are near completion for both the TRS-80 and Apple II computers.

West Coast Consultants, 1775 Lincoln Blvd., Tracy, CA 95376.

**CIRCLE 278 ON READER SERVICE CARD**

### TWO FOR TRS-80

Mail-V is a package of Series V business software for the TRS-80 DOS system with 32K. Features include input and edit features which let you move the cursor, delete character, line and replace characters by typing over it and a report writer. You do not have to sort the entire data base everytime you add records. Sorting the entire file takes minutes instead of hours, and we provide a separate module to handle sorting numeric zip codes. Any fields can be sorted or searched. Price: $59 with full documentation and delivered on diskette. Manual alone: $5.00. CP/M version available soon.

TRS Yellow Pages, issue 1.4, is a twelve-page publication devoted entirely to business software. A handy guide for selecting business software for the TRS-80, it describes all the software produced by Micro Architect. Issue features a sophisticated data base manager for the TRS-80. For a free copy, send two stamped, long, self-addressed envelopes.

Micro Architect, 96 Dothan St., Arlington, MA 02174.

**CIRCLE 279 ON READER SERVICE CARD**

## MISCELLANEOUS

### HOUSING FOR MINI-DISKETTES

Designed specifically to house 50 mini-diskettes, the Mini-Matic is lightweight and portable. Three supporting metal tilt plates provide adjustable spacing in 1" increments. The Mini-Matic Tray is offered as part of a complete outfit which includes the tray, a set of five sturdy index/dividers, and a clear vinyl dust cover. The tray can be cross-filed in any standard letter-size file drawer. A locking steel hood is available as an option.

Mead-Hatcher Associates, Inc., 752 Military Road, Buffalo, N.Y. 14216.

**CIRCLE 280 ON READER SERVICE CARD**

## PERSONAL COMPUTING CASSETTE

Verbatim
C-10
Verbatim.
50 FT.
Digital Cassette for Personal Computer Use

A new data cassette from Verbatim Corporation includes leader-free and splice-free tape, a shell of material which minimizes jamming; and premium-grade tape. Designated C-10, it is designed for all popular personal computer systems.

Verbatim Corporation, 323 Soquel Way, Sunnyvale, CA 94086.

**CIRCLE 281 ON READER SERVICE CARD**

## COMPLETE YOUR TRS-80 SYSTEM

Now, for the Owner's of the Radio Shack TRS-80 Micro-Computer Module System, DESIGNCO, P.O. Box 307, Union, Michigan has put in kit form an attractive, vinyl-covered, wood and ABS thermoformed plastic case. When assembled the unit encases the separate modules and interconnecting cables securely and efficiently for a permanent work location or allows for safe portability if movement of the computer system is required.

The C-1 case for the TRS-80 is made of black ABS thermoformed side panels with the exposed wood sections covered by a silver, leather-like material, giving the completed unit a custom-made, whole-system appearance.

Assembling the unit with just a phillip's screwdriver is facilitated with predrilled holes, uniform screw size and very comprehensive instruction. Unit specifications: 14 x 19 x 25 inches, weight - 9 pounds. Price and shipping: $69.50 plus $5.00 shipping.

Interface systems with space for 2 disc drive units.

The C-2 case for the TRS-80 is made of black ABS thermoformed side panels with wood sections covered by a silver, quilted, leather-like material, giving the completed unit a custom-made, whole-system appearance. A glare shield to reduce light reflection is integral to the design. Room is provided for additional add-ons such as printer interface, S-100 buss, 44 pin buss, etc. Unit specifications: 25" wide 18-1/1" deep x 28-1/2" high, weight - 14 pounds, disc opening - 3-5/8" x 12-1/2" x 14" deep,(accepts two Radio Shack, Pertec, Vista, Matchless, Percom disc units.) Price and shipping: $135.00 plus $7.00 shipping.

Designco Consulting Eng., P.O. Box 307, Union, MI 49130.

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## TRS-80 disk software

DATA BASE MANAGER You can maintain a data base & produce reports without any programming. Define file parameters & report formats on-line. Almost use up the required 32K memory. $49.

ACCOUNT manage client accounts & account receivable. Automatic billing & transaction recording. 32K req. $59.

WORD PROCESSOR Specifically designed for the TRS-80. Written in BASIC. No special hardware and text limit. $39.

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MAIL print reports & labels sorted by any field. Random access. special buffering technique. $35.

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**CIRCLE 151 ON READER SERVICE CARD**

**MICRO ARCHITECT**
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## INTRODUCING HEWLETT-PACKARD'S HP-41C. A CALCULATOR. A SYSTEM. A WHOLE NEW STANDARD.

The new HP-41C from Hewlett-Packard is a powerful programmable calculator that features: an LCD display with alphanumeric capability, 63 registers of data storage or up to 400 lines of program memory—expandable to 319 registers or up to 2,000 program lines; up to 6 levels of subroutines; 10 conditionals and 56 internal flags; specific loop control; indirect addressing; local and global branching; Continuous Memory; RPN logic.

And when you need them: Memory Modules—plug-in modules for storing programs and data; an "extra smart" Card Reader; a Printer that prints upper and lower case alpha plus special characters and does high resolution plotting; the Wand to input programs in bar code form (available early 1980); Application Modules—preprogrammed, plug-in modules that give solutions to a wide range of problems.

The HP-41C lets you reassign any standard function, any programs you've written, or programs provided in the Application Modules—to any keyboard location you want. And of course Hewlett-Packard backs the HP-41C with total software support including an Owner's Manual and thousands of programs in the HP-41C Applications Pacs, Solutions Books, and the HP Users' Library.

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1.) Memory Modules

2.) The Printer

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**CIRCLE 123 ON READER SERVICE CARD**

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**Be A Computer Literate**

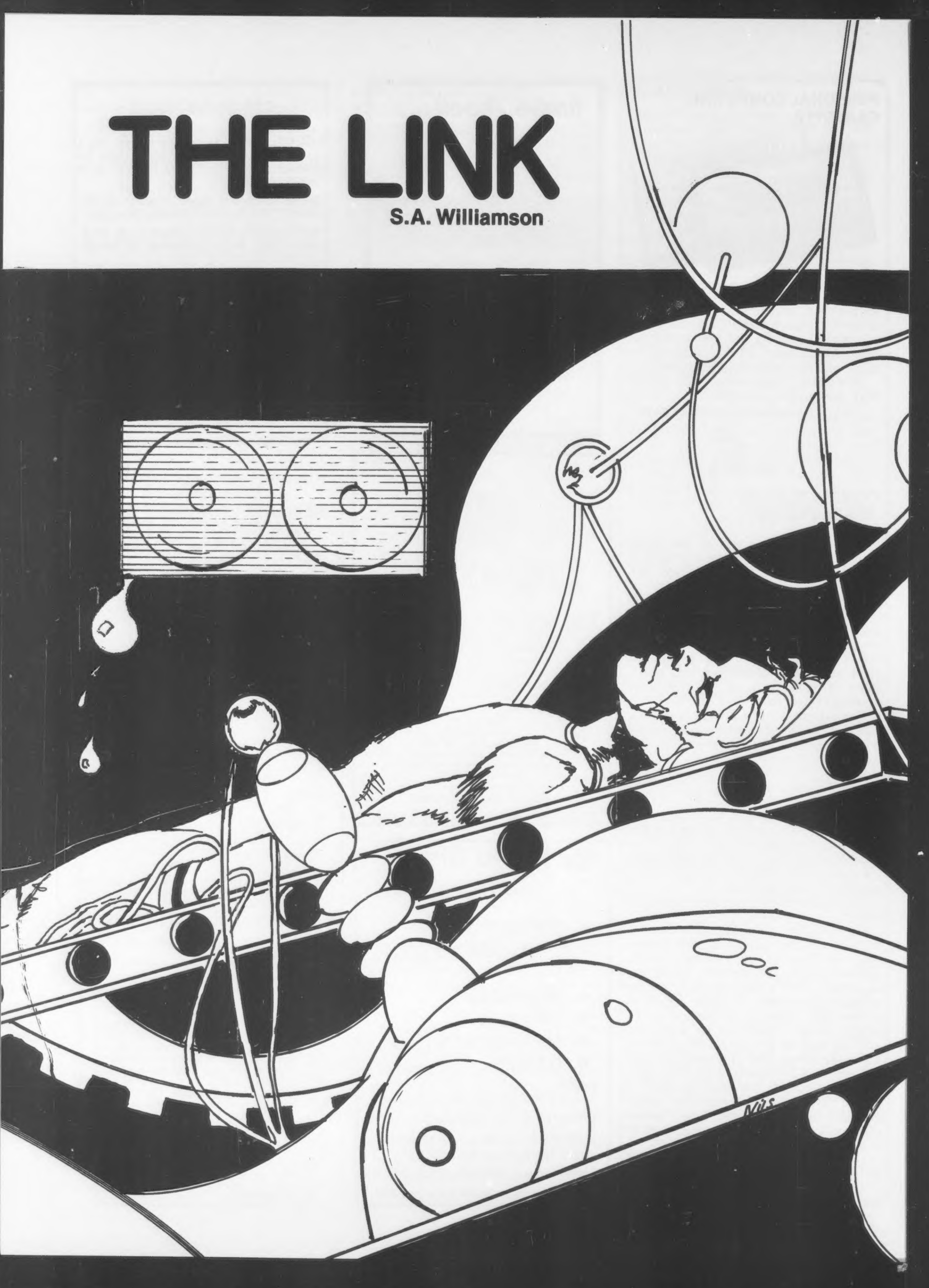
by Marion J. Ball and Sylvia Charp

This is the most basic, introductory book on computers ever put together for instructional use. Its full-color diagrams, drawings, photos and large, explicit type make this book a pleasure to read.

Softbound, 61 pages, $3.95 plus $1 shipping and handling in the U.S. ($2.00 foreign). N.J. residents add 5% sales tax. Send your order to Creative Computing, P.O. Box 789-M, Morristown, NJ 07960. Visa, MasterCharge and American Express welcome. For faster service, call in your bankcard order to: **800-631-8112** (in NJ, call 201-540-0445).

# THE LINK

S.A. Williamson



V5/10 OC 79 MI

A narrow passageway ran the entire length of the ship, but none of the crew walked along it. A small, cleverly designed compartment contained millions of credits worth of the most sophisticated communications equipment in the Federation. None of the crew had ever used it. The crew's mess, the recreation room, even central control, were neat, polished, and untouched by human hands for nearly a century.

In the inner, most protected part of the ship, long plexi-fronted cases, stacked three tiers high, lined each side of a large chamber. In the upper right hand corner of each case, a small control panel displayed unlabeled switches and a row of three lights.

All the lights glowed a deep steady red; all except one. The center case on the port side showed a pulsing yellow light. The figure in the case looked no different from the other 23. His body functions, like theirs, were immeasurably slowed, the birth and destruction of cells all but suspended in the stasis field. Only his brain functioned normally.

Captain Yemana was in constant contact with the on-board computer that ran the ship while the humans slept.

The link had grown stronger over the years as Yemana lived through the boredom, expectations and disappointments of a hundred years with only Ship to talk to.

Ship had also grown stronger through the link, its "ideas" expanded through constant contact with the human. Yemana's thoughts, his feelings, hopeful and bitter, even his dreams were second nature to Ship. Perhaps by now they were first nature.

The dividing line between the two had eroded away during the years like sandstone washed away by the rain. Yemana's brain calculated and Ship's mental whistle echoed between them as they coasted on, seeking an inhabitable planet from those Ship sifted through constantly.

Had Yemana thought about it, he would have been forced to admit that he and Ship had become friends, and that he'd miss the contact when it was broken as eventually it must be. He had forgotten many things in a hundred years; among them how to deal with people.

Ship called his attention to a Sol-type star, less than half a light day away. Six planets orbited the star, and one seemed particularly inviting. It was smaller than Earth with a gravity .85 that of the mother planet. The atmosphere was richer in oxygen than Earth and two moons circled the planet which was something over 80% water.

Yemana waited impatiently for most of a day until they were close enough for Ship to tell something of the planet's native life.

It turned out to be mostly vegetation. The planet was too far from its primary to get much natural radiation, thus making the evolutionary rate pitifully slow, the highest form of animal life were insects. Yemana ordered Ship to shape orbit and begin the tedious process of testing soil, air, and water to be as sure as possible that they contained nothing lethal to human life.

Ship and Yemana ingested the data as fast as it came but it took Yemana the better part of a day to make a decision. After a hundred years he was not as eager as he'd imagined to leave the security of Ship. He gave the order to activate his life case.

Awareness of his body seeped gradually back to him. A gentle heat swept through him as Ship injected the drugs that would loosen and stimulate long dormant muscles. He opened his eyes and blinked several times before slowly and painfully turning his head to the side. His first officer, Aprilli, was directly across from him. The light above her case glowed yellow like all the others. His own light was reflected in the front of her case. It was a bright pulsing green.

The surface beneath him was warm and gently vibrating; massaging life back into long unused flesh and blood. At last the front of the case slid silently up and the recirculated air of the ship flowed in to him. He lay still a few more moments, then made a final effort.

He sat up gingerly and feeling no ill effects, swung his legs out and stood, or rather leaned against the case. He took a deep breath as dizziness washed over him. It hurt deep in his chest.

DO NOT WORRY. THIS IS NORMAL. IT WILL PASS.

Yemana nodded before he realized with a start that it was not the ship's speaker he heard but the same soft mental whisper he was long accustomed to.

"Ship?"

THE CONTACT HAS NOT BEEN BROKEN AS IT SHOULD HAVE.

"Has this ever happened before?"

NOT ACCORDING TO MY RECORDS. BUT OURS IS THE LONGEST UNINTERRUPTED SLEEP VOYAGE IN FEDERATION HISTORY.

As Yemana walked the length of the ship and cautiously exercised, his thoughts were not on the mission but on the continuing link with Ship. Ship quietly interrupted his musings.

FIRST OFFICER APRILLI WILL AWAKEN MOMENTARILY.

After he had helped Aprilli, the other members of the crew began to wake at regular intervals. Even after all were safely conscious he could not relax. The next several days were taken up with increasingly strenuous exercises designed to restore the crew's strength and co-ordination. Yemana, Aprilli and Ship also made plans for landfall.

Yemana still made no mention of his continued link with Ship.

As Captain, he would not be included in the first landing party; it was too dangerous. He reclined in the long unused pilot's couch and maintained radio contact with the shuttle.

THEY HAVE LANDED SAFELY.

Ship reported even before Aprilli could relay the information.

Events proceeded according to plan and the base camp and temporary lab were quickly established. Nearly all the scientist's reports were favorable. The planet was as near optimum as they could reasonably hope for, so Yemana launched the message drone. Being smaller in mass and not hampered in speed or type of fuel by carrying life forms, the drone would make the trip back in about half the time it had taken them to blast out. About 50 years.

As the scientists had agreed that the planet was safe, aside from a few large predators that could not get through their screens, Captain Yemana released the crew to go down to the planet for a few days before they went back into stasis to search for another likely colony planet.

Yemana did not visit the planet himself. He suffered from a fear of open places, overcome, of course, through hypnotic treatment, but he was happier aboard ship.

Three days passed and the crew seemed to be enjoying their stay on the planet, but it was time to move on. He gave the recall orders, allowing the party another day to dismantle the base. He was slightly surprised when Aprilli and five others appeared within an hour, still in planetary gear, down to their laser pistols.

---

S.A. Williamson, 5128 Gaviota Ave., Long Beach, CA 90807.

"Captain, we've taken a vote. One good colony planet is all Command can reasonably expect of us, and this one is a gem. We want to stay here. None of us want to return to stasis,"

"So, you've voted have you?"

They nodded eagerly.

"Well I vote no. Your motion is defeated. You'd better go back down and help the others."

"Captain, aren't you even going to listen to us?"

"I have listened. This isn't a democracy. I've overlooked the fact that you're committing mutiny. I won't overlook it much longer. Any further disobedience and you'll be formally charged."

There was a momentary silence as they considered the penalty for mutiny.

"You can't push us all out of the airlock Captain. If you persist you may find the positions reversed."

Not one of them wavered under his accusing glare. "So," he thought. "They had it all planned before I gave the recall order."

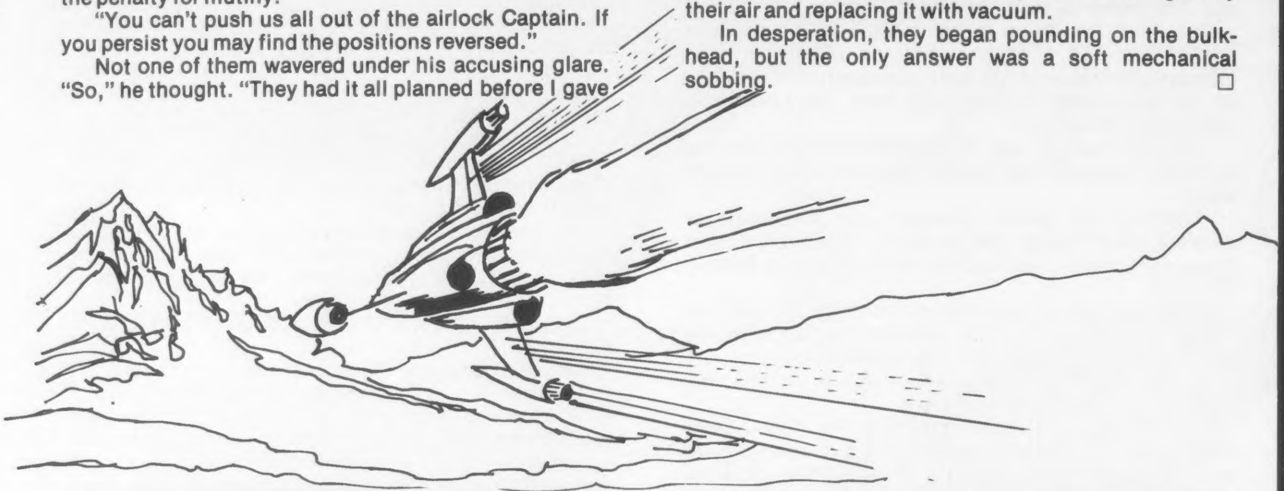
He backed a few steps before telling Ship to close the emergency bulkheads. One of the men already had his laser out and managed one blast as the bulkhead slid between them.

It was a lucky shot. Even as Yemana called out to Ship, his life slipped away.

The officers in the next compartment were trying to open the emergency bulkheads but it was impossible without Ship's help, and he would not answer, if he even heard them.

They huddled together as the funeral dirge echoed through the otherwise empty corridors. As the last melancholy notes faded away, they noticed the first changes in the atmosphere. Ship was bleeding away their air and replacing it with vacuum.

In desperation, they began pounding on the bulkhead, but the only answer was a soft mechanical sobbing. □



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–Adapted from CCMA bulletin by many persons $\sqrt{\infty}$

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CIRCLE 148 ON READER SERVICE CARD

# Software Legal Forum

### Harold L. Novick

Having recharged the phaser banks since last month, it is again time to travel forth in the starship and see what candle light can be discovered in the black abyss that contains software legal problems. As could have been predicted, no outstanding solutions appeared during the previous month, and the problems that existed before are still around.

The battle scene described last month involved the accusation of **Creative Computing** publisher David Ahl of copyright infringement by the CP/M® User's Group (CPMUG) and Tony Gold, one of the CPMUG organizers. The alleged infringement involved the CPMUG's distribution of floppy diskettes containing enhanced software that was admittedly adapted from the copyrighted book, **101 Basic Computer Games**. Copyrights are interesting animals and they will be the focus of this month's article. In a sense, copyrights are like the characters in the movie, "Star Wars." They are clearly different, yet they look and act like something that is familiar. Then, upon still further reflection, a mystical aura is noticed that warns they may be more than they appear to be.

The copyrighted work in the Ahl-CPMUG controversy is a book containing the listings of the computer software for computer games in a form directly perceivable by the human eye. The accused infringing activity is the copying and distribution of floppy diskettes containing the computer software of enhanced computer games in a form perceivable with the aid of a machine. The differences between the two should be apparent. In the first, the medium of expression is a book; in the second it is a floppy diskette. In the first, the manner of "fixing" the work to render it "sufficiently permanent or stable to permit it to be perceived, reproduced, or otherwise communicated for a period of more than transitory duration" is by printing the letters and numbers of the programs with permanent ink on paper. In the second, the work is "fixed" by recording binary, magnetic representations of the numbers and letters of the programs onto a diskette. In the first, the work can be read with the unaided eye; in the second the work can be read with the aid of a machine. In the first, the copyrighted work is in one version (or dialect) of BASIC, in the second the work is enhanced and is in a CP/M® version of BASIC. Many of the programs in the first work are said to have bugs and cannot be run. All of the programs on the floppies are said to run and have been debugged.

In complete obscuring simplicity, the new Copyright Act declares an infringer of a copyright to be "[a]nyone who violates any of the exclusive rights of the copyright owner...." The Act lists five exclusive rights, three of which apply to all seven categories into which works of authorship have been divided. The other two exclusive rights apply only to some of the categories. The Act then lists six limitations on the five exclusive rights followed by six paragraphs restricting the scope of the five exclusive rights. If it sounds complicated, it is; but in concept and for particular applications, it can be simplified.

Although a work can be in more than one category and the list of categories is not meant to be all inclusive, the nature of a computer program can be better deciphered if it can be fitted into one of the categories. Nevertheless, without regard to how just one computer program would be categorized, it is clear that a book of computer programs would be in the category called "literary works." The other six categories are musical works, dramatic works, pantomimes and choreographic works, audiovisual works (e.g. motion pictures), sound recordings and pictorial, graphic and sculptural works. Where would one computer program fit in? CONTU, a governmental study commission, has stated that a computer program, per se, should be categorized as a literary work. On the other hand, computer generated music is categorized as a musical work and the sound recorded form is categorized as a sound recording. And a computer program stored on a floppy diskette that generates a video display, if copyrightable, might be classified as a motion picture (if it consisted of a series of related images that impart an impression of motion when shown in succession).

The exclusive rights which every copyright owner of a literary work has, including the owner of a book of computer programs, are the rights to reproduce copies of the work, to prepare derivative works, to distribute copies, to perform the work publicly and to display the work publicly.

---

Harold L. Novick, Patent Attorney, Larson, Taylor and Hinds, Arlington, Virginia 22202.

## Legal Forum, con't...

The CPMUG was accused of having embodied the copyrighted written computer programs on a floppy diskette. Is that an infringement of the exclusive right to reproduce copies of the book? A copy is defined by the new Copyright Act as a material object in which a work is "fixed" and from which the work can be perceived or communicated, either directly or with the aid of a machine. Thus it does not matter that the original is a book and the copy is a floppy diskette. Assuming that the copied programs were owned by the book publisher (a fact disputed by Tony Gold, but more on that next month), if a page of the book containing a computer program were photocopied, that could be an infringing copy. If that page were copied by being typed on a typewriter, that also could be an infringing copy. Therefore, if that page were typed on a computer keyboard and stored on a floppy diskette, that, too, would be an infringing copy if the other two were.

But, you say, the CPMUG did not type a page of the book, they only took some of the programs and revised, edited, corrected and enhanced them. So they did not just copy the book, you argue. Without conceding the point, it does not matter, because by revising, editing, correcting and enhancing, CPMUG prepared a derivative work, and that is an infringement of an exclusive right. A derivative work, and that is an infringement of an exclusive right. A derivative work is defined by the new Copyright Act as a work based upon one or more pre-existing works and includes translations, abridgments, revisions, annotations, elaborations or other modifications.

Thus infringement cannot be avoided because one work is a book and the other is a floppy diskette; one is directly perceivable and the other requires a machine; one is the original and the other is a corrected, enhanced version.

However, infringement can still be avoided through one of the six limitations on the exclusive rights or one of the six restrictions on the scope of the exclusive rights if they are applicable. Is one applicable? In this writer's opinion, yes and no. No infringement is avoided by the CPMUG's distributing the floppy diskettes, but it may be avoided by the authors who enhanced the programs during the enhancing process. It may also be avoided by the end users of the floppy diskettes. In addition, certain writings are not copyrightable. Thus a procedure or method of operation regardless of the form in which it is embodied cannot be protected with copyrights. Are computer programs within the excluded areas? Some, arguably, are; some, arguably, are not.

But all of one's torpedoes cannot be fired at once. There are many more items to be considered and explored before a "simple" answer can be given to this "simple" problem. Stay tuned until next month to see if any of those nasty Klingons (Choose one: Ahl, CPMUG, Gold, all of the above, none of the above.) escape. □

*The comments and opinions of the author are given for educational purposes only and are not meant to be legal advice. Specific legal questions should be referred to your personal attorney.*

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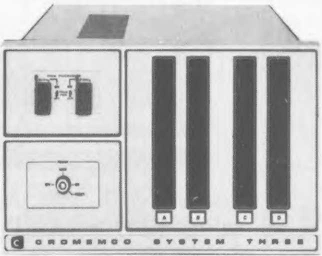

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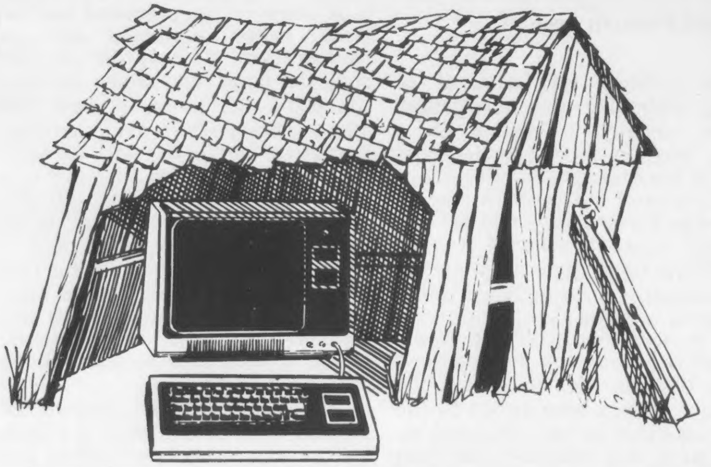
# TRS-80 Strings

**Stephen B. Gray**



For this eleventh column, we'll look at another aspect of TRS-80 graphics with programs that create Mondrian-like designs, check out two program-development tools, the Editor/Assembler and TBUG, peek into a publication aimed at assembly-language buffs and then look once more at two free modifications.

### Mondrian Art

Random-number graphics can be used to produce designs reminiscent of paintings by Mondrian, whose works consist mainly of intersecting black horizontal and vertical stripes on a white canvas.

Try this simple program

```
10 CLS
20 X = RND(5)*RND(8)
30 Y = RND(5)*RND(4)
40 SET(X,Y)
50 GOTO 20
```

and you'll have the equivalent of intersecting black lines on a white canvas.

You'll also have a graphic representation of what might be called a visual type of multiplication table, or the product of two number sets. What you've made the TRS-80 do, for the vertical coordinates, is to multiply the set (1,2,3,4,5) by the set (1,2,3,4). Thus the vertical coordinates are defined by the product set (1,2,3,4,5,6,8,10,12,15,16,20,25).

Looking at the screen, you see that the graphics blocks are set vertically in the pattern 1-6, 8, 10, 12, 15-16, 20, 25.

With a similar result in the horizontal coordinates, you get "black stripes on a white canvas." This effect can be heightened if you surround the "canvas" with a rectangle or two of graphics blocks, to set off the "black stripes." But first surround the "canvas" with a rectangle of blank graphics blocks, because otherwise those rectangle(s) will mix with the "painting."

This simple program could be turned into a general one, with INPUT statements, so the user could enter varying numbers, and thus create a variety of "TRS-80 Mondrians."

The pattern can be broken up more by putting more RNDs in a line:

```
10 CLS
20 X = RND(5)*RND(2)*RND(2)
   *RND(2)
30 Y = RND(5)*RND(2)*RND(2)
40 SET(X,Y)
50 GOTO 20
```

which creates, in effect, more and wider black stripes by making the product set a more limited one.

For example, if you'd like to make similar patterns, and would like to know just what numbers the lines represent, markers can be created by adding these lines:

```
12 FOR Z = 0 TO 40 STEP 10
14 SET (Z,24)
16 NEXT Z
```

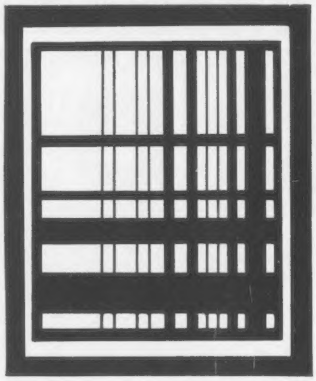
to the previous program. As an exercise in printing numbers next to graphics block, which takes a little programming work, you could put the numbers 0, 10, 20, 30 and 40 just below those markers.

Since several expressions are repeated in the previous program, you might think the program could be simplified by changing it to:

```
10 CLS
20 A = RND(5)
30 B = RND(2)
40 X = A*B*B*B
50 Y = A*B*B
60 SET(X,Y)
70 GOTO 20
```

but you'll be quite surprised by the result. The reason, of course, is that while the previous program turns on dozens of graphics blocks to represent the entire product set, which has horizontal values of: (1,2,3,4,5)*(1,2)*(1,2)*(1,2) this last program turns on only 10 blocks, in two diagonal lines, because now there is only one Y-coordinate for each X-coordinate.

If you had trouble surrounding the first Mondrian program with a blank rectangle and then with a rectangle of graphics blocks, here's a program



that will do it, and also place the pattern at the center of the screen:

```
10 CLS
11 FOR X = 38 TO 83
12 SET(X,9)
13 SET(X,32)
14 NEXT X
15 FOR Y = 10 TO 31
16 SET(38,Y)
17 SET(83,Y)
18 NEXT Y
20 X = RND(5)*RND(8) + 40
30 Y = RND(5)*RND(4) + 10
40 SET(X,Y)
50 GOTO 20
```

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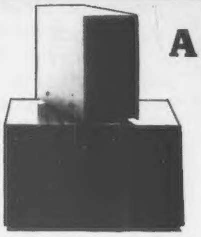

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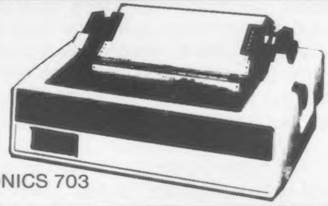

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## Strings, con't...

Incidentally, one feature in a Mondrian you can't duplicate on a TRS-80 is the brightly-colored intersections of the lines. However, just as a guess, a future Radio Shack computer, perhaps the "TRS-80 Mark III," may have color capabilities.

### Assembly Language

You've probably heard the saying, attributed to one of the turn-of-the-century millionaires, "If you have to ask how much it costs to keep a yacht, you can't afford one." A similar saying seems to be the motto of people who write about software, "If you have to ask why there is a need for assembly language, you don't need it."

Call it assembly language, call it assembler, call it even ALC (Assembly-Language Code), it's surrounded by a mystique, which may well have been fostered by programmers and systems analysts, who like to point out that programming is more an art than a science. This helps justify the fact that the average programmer writes about 15 lines of ALC a day. That's 15 lines written, debugged **and** documented.

The manual accompanying Radio Shack's $29.95 Editor/Assembler package tells you how to use the accompanying cassette tapes, but doesn't say a word about why you might be, or should be, interested in assembly language. Because some TRS-80 owners apparently ordered item 26-2002 without really knowing what they were asking for, the newer catalogs now have an asterisk beside that item, as well as beside TBUG, with the footnote, "*Intended for advanced programmers only."

Zilog's 298-page **Z80 Assembly Language Programming Manual**, mentioned in the introduction to 26-2002, assumes you know what assembler is for, and gets right into the thick of it without trifling with an explanation of its uses.

Radio Shack's 40-page manual, **TBUG Z-80 Monitor and Debugging Aid**, which we'll look at later on, was written some time after the original small 12-page booklet (with 8 pages of text) accompanying the cassette tape proved to be too skimpy even for "advanced programmers." TBUG is used mainly to debug assembly-language programs.

The TBUG manual doesn't tell you, in non-programmer language, why you might be interested in TBUG, but it does list three books in Appendix G for those who would like to learn to write machine-language programs. More about machine language in a moment.

One is the Zilog book just mentioned. Another is **The Z-80 Microcomputer Handbook**, by William Barden, published by Howard W. Sams & Co., which dives right into the hardware after two pages on the history of the Z-80. The third book, Adam Osborne's **Z80 Programming For Logic Design**, assumes you already know what assembler is, and/or that you've read the Osborne book **An Introduction to Microcomputers**, to which the Z80 book is a sequel.

(Incidentally, although Zilog calls it the Z80, Radio Shack usually refers to it as the Z-80 processor, as do many authors. Radio Shack also uses both T-BUG and TBUG in print, as well as both Level-II and Level II.)

For an explanation of what an assembler can do for you, let's look at Issue 6 of the Heath computer user's magazine, **REMark**, which has a brief item on the assembly-language programming course for the 8080/8085, titled "Assembly language programming? What's in it for me?" It says:

"The most powerful language to use on any computer is ASSEMBLY LANGUAGE. Wait! Hear this out! It's not long. Consider the fact that ANYTHING that can be done in any other language on a particular computer can be done in Assembly Language. And it is a true programming language, not just a convenient notation for machine code. The use of labels, computed operands, comments and assembler directives allows the assembly language programmer to create a source code that is adaptable to the system and easily read. One of the most useful features of a programming language is that it is flexible, and not dependent upon specific addresses and hardware of the computer. In an assembly language program, hardware specifications can be made at the beginning and referred to symbolically through the rest of the program. In this way, any changes that may be needed are located together and are easily located. By using "computed" origin statements, and other assembler directives, you can make an assembly language program operate wherever the computer has space. The use of meaningful labels for subroutines, along with as many remarks or comments as you desire, makes the program listing quite readable.

"Perhaps the most fascinating fact concerning assembly language is that anything your computer is capable of can be done with assembly language. To run a program written in BASIC, the computer interprets the instruction and performs all the machine operations necessary to do that instruction. The programmer can do everything with assembly language that could be done in BASIC, because there is a mnemonic for every machine operation. Further, to run a program written in BASIC, the BASIC program must be in memory. After it has been assembled, an assembly language program performs the operations without that support, and because the instructions are not to be translated, the program runs much faster."

A leaflet describing a three-day $405 course in "Programming the 8080 in Machine and Assembly Language," given last October at George Washington University, provides a more succinct explanation: "Assembly language, rather than a higher-level language such as BASIC, allows the user to make more efficient use of memory space and processing time, to control arbitrary input/output devices, and to work with computers too small to support a BASIC interpreter."

To put it more plainly, most real-time programs have to be written in assembly language, because BASIC is too slow. If you wrote a Lunar Lander program in BASIC, the lander would crash while the BASIC inter-

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from Device Orientated Games

An excellent adopatation of one of the (first) oldest and best loved computer games by the same name. In machine language with a variety of options and for two players. Play with or without the gravity of the sun, for example. One of the best. $9.95

### starfleet orion

from Automated Simulations

Tactical, two-player space wargame. 80-US stated that the "game is challenging and complex, and there are so many variations that it can be fun for a long time." For serious gamers. Includes listing, cassette, and battle manual. $19.95

### invasion orion

from Automated Simulations

The exciting, solitare version of "Starfleet Orion." $19.95

### galactic blockade runner

by Tim Quinlan from Mad Hatter

A unique, fast paced, and tough game. As exciting and frustrating as pinball. $9.95

### space games3

from Creative Computing

Four programs including the classics of Trek and Star Wars plus a new one called Romulan. The fourth, Star Lanes is a great, multiple player, barter and trading game. $7.95

### star trek

by John Christman from Acorn

Sound and a non-scrolling display make this version interesting for any Captain. In real time and with moving Klingons. $9.95

### time trek

by Joshua Lavinsky from Personal

"...truly a brillant program..." said 80-US and we agree. In machine language and in real time, you really have to move in this game. Includes sound effects. $14.95

### ultra trek

by William Schroeder from Galactic

Fast, enjoyable version with your mission to destroy the hostile base, 30 Klingons and 15 Romulans. Well documented. $14.95

### star trek III.3

by Lance Micklus from TRS-80 Software Exchange

Nice graphics, a 3D galaxy, and an unusual mission make this version popular. $14.95

### space trek IV

from Instant Software

Two games. In Stellar Wars you attack the Death Star and fight off tie fighers. Also includes Population Simulation. $7.95

### x-wing

by George Blank from TRS-80 Software Exchange

Put yourself in the cockpit of an X-Wing fighter using radar, long range scans, laser cannons, and torpedoes to attack the Death Star. $7.95

### space warp+

by Mike Partain and Ray Daly from Acorn

Both have sound effects. Good luck positioning the cross-hairs on the tie fighters in Star Warp. Also a graphic lunar lander game. $9.95

```
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### air raid

from Small Systems

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by Miller Microcomputing

Professional, fast and powerful lanuage supplied with demo programs. Disk $65. Tape $45.

### FORTRAN

by Microsoft

The scientific language available for the TRS-80 at a new, low price. Requires one disk drive and 48k. $90+5 shipping. With macro-assembler $175+5shipping.

## NUMBERING

by Tom Stibolt from Acorn

Several commands found in other BASICs are left out of the Radio Shack versions. This machine language package will add several commands to your system. And they are available directly from BASIC using the NAME command.

Normally loading more than one BASIC program into memory is a problem. With the append feature of this package you can load another program without losing the program in memory. In either Level II or DOS, you can create one combined program with a menu to access other appended programs. The thorough documentation supplied by Acorn shows you how to do this and more.

This package adds to your system a complete BASIC renumbering command, written in machine language. Whether you want to renumber an entire program, or only one section, it is the fastest renumbering routine we have seen. Optional arguments to the command allow you to specify the new starting line number and the increment. Also, for renumbering only a section of your program, you can specify the first and last line number.

Renumbering improves BASIC programs in many ways. Renumbering a program before printing it makes it easier for others to type into their machines. It also makes it easier to follow the structure of programs, especially if the blocks of the program are seperately renumbered. As a debugging aid, renumbering of an entire program will detect any undefined line errors faster than running the program itself. And, the memory requirements of programs can be reduced by simply renumbering with a small increment and a small starting number.

Another command allows you to fix or recover NEWed programs or those lost by a DOS reboot.

> Paul Bump of Warsaw, Indiana wrote us about Numbering to say that he "can't imagine anyone being without it. This is a must for everyone."

The 16k, 32k and 48k versions are all on the same tape for 14.95.

## SYSTEM DOCTOR

from Bottom Shelf

Assure yourself that your TRS-80 is working properly. The causes of hardware problems are often hard to detect, but you can now do a thorough diagnostic check of your entire computer. It checks the ROM, the RAM, disk drives, video memory and display and cassette recorder. Also provided is a special test tape and a 12-hour test with a recording of results to find those occasional errors. $28.50

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## Strings, con't...

preter is fiddling with the high-level language.

Also, because TRS-80 BASIC input/output commands control only cassette drives, disk drives and printers, you have to use the USR function (in Level-II) to call an assembly-language routine if you want to control any other I/O device, such as the RS-232C serial interface board.

The $29.95 Editor/Assembler, which works in both Level-I and Level-II, lets you type in assembler code for all or part of a program, then translates this symbolic language into a "machine-executable code," meaning a code that can be understood by the Z-80 processor.

After you load the Editor/Assembler into your TRS-80, you use the same commands for editing and changing your assembly-language programs as used in Level-II BASIC, such as I to insert and D to delete.

You write your program in assembly language, such as

```
LD A,H
```

and when you've finished typing your program, you hit A to "assemble" your program, and it is then translated into machine-readable code, which is a sequence of binary digits.

If you've made any mistakes in entering your program—mistakes of the type the assembler can recognize—you get a display of the number of total errors at the bottom of the assembled program, and error messages within this program that tell you if a line is wrong because of an ILLEGAL OP CODE, or EXPRESSION ERROR, etc. So you use the various commands to correct your program, until the number of TOTAL ERRORS is 00000.

When you finish, the screen displays your original program, plus two new columns. The first column consists of the relative addresses in which the assembled program will reside, the first of which you have specified with an ORG pseudo-op. ORG is one of the nine assembler directives which are commands to the assembler rather than to the processor.

The second column is the opcodes, which are hex-code equivalents of the binary machine-readable code, as well as being the equivalents of the assembly-language codes. For example, the opcode for LD A,H is 7C, which you can find in any Z-80 reference manual, usually under "8-Bit Load Group."

During execution of your assembly-language program, the binary equivalent of the 7C opcode, or 01111100, is put onto the data bus and fed itno the Z-80, which can understand only binary numbers. The Z-80 processor has an Instruction Decode section that looks at 01111100, which for convenience we call 7C, and determines that it means "load the contents of register H into register A," which is what LD A,H specified.

The 7C opcode is said to be in machine language, because it is the hexadecimal equivalent of the binary 01111100.

The Editor/Assembler package consists of a three-ring binder with three cassettes and a 136-page User Instruction Manual. The first cassette is the editor/assembler, the second is a System Tape that permits using the editor/assembler in a Level-I machine and the third is a blank cassette for recording your assembled program on tape.

Incidentally, as the manual notes, "BASIC program tapes may NOT be edited by the Editor/Assembler."

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**ESP-1: $29.95** Editor, assembler, and monitor using INTEL 8080 mnemonics.
**RSL-1: 14.95** Draw patterns, then play Conway's LIFE in machine language.
**LST-1: 8.00** A disassembled listing of LEVEL-1 BASIC with some comments.

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## Strings, con't...

### TBUG

As noted previously, TBUG, which will cost you $14.95 for the Level-I/II cassette and 40-page manual, is used for program development. You write a program using mnemonics (such as LD A,H), assemble it with the Editor/Assembler package, set breakpoints with TBUG and step through the program section by section, with the use of TBUG, checking it out.

Three things can be done with TBUG that can't be done with the Editor/Assembler, and which are important for program development. You can examine the Z-80 registers, examine the contents of RAM memory and set breakpoints. These three capabilities are described on page one of the manual, **TBUG Z-80 Monitor and Debugging Aid**:

"TBUG is a powerful machine-language monitor designed to give you direct access to the Z-80 CPU, which is the heart of the Radio Shack TRS-80 Microcomputer. TBUG provides the capability to:

1. Create and modify machine-language programs.
2. Debug machine-language programs through the use of breakpoints and register displays.
3. Examine and modify the contents of RAM memory and Z-80 registers.
4. Save and load machine-language programs using cassette tape.
5. Execute machine - language programs created using TBUG (if you have a Level II TRS-80, you can also execute programs created with the Editor/Assembler program via TBUG)."

Remember, we're not talking about BASIC here. We're talking about writing a program in assembly-language mnemonics, translating it to binary machine-language with an assembler and checking it out with TBUG. This is a long way from the simplicity of programming in a high-level language such as BASIC or FORTRAN, where much of the housekeeping is taken care of for you by the BASIC interpreter or the FORTRAN compiler.

But if you want to get into real-time programming, if you want to be able to write input/output routines for other than standard peripherals, and if you want to find out what really makes the TRS-80 tick, then you'll have to get yourself the Editor/Assembler and TBUG.

### Insiders

Once you begin to get into assembly language and/or TBUG, you should take a look at **Insiders**, subtitled "TRS-80 hardware journal with machine software," $7.50 for six undated issues, from Computer Cablevision, Inc., 2617 42nd St. NW #2, Washington, DC 20007.

**Insiders** prints several assembly/machine-language programs in each issue, such as one that will display double-width characters (32 per line) on a Level-I machine (issue 3.0), a printer driver (issue 8.0) and a sound-effects program (LSOUND, issue 10.0).

**Insiders** also lets you know what other TRS-80 publications are around, explains many of the inner workings of the TRS-80 assembler and TBUG, shows how to make hardware modifications, provides tutorial articles such as "Level II ROMs Differ," "New Languages," "Microsoft FORTRAN for the TRS-80" and

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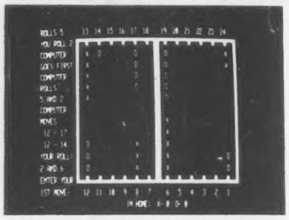

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reviews software such as Electric Pencil, FORTN and NEWDOS.

Anybody who's really into TRS-80 lower-level languages should subscribe, or at least send in $2 for a sample issue. Editor Ray Daly and his crew provide a great deal of information for hard-core software fans at a reasonable price. **Insiders** consists of only four pages of 8½-by-11 inch colored paper, folded over to provide 16 small pages, and the text is typed and photo-reduced, but you won't find any other TRS-80 publication with more information packed into only 16 pages.

Another division of Computer Cablevision is Realsoft, which offers TRS-80 software by **Insiders** staff and outside suppliers, including games (backgammon, Space Warp, Microchess), operating programs (RENUM, disassembler for TBUG, 32 Char/Line), CAI programs (IQ Builder), etc.

### Those Two Free Mods

In the May, 1979 TRS-80 column (page 130), I wrote that two modifications are available free of charge if you're having certain problems.

First is the buffered cable that goes between the keyboard/CPU and the expansion interface, if you've got RAM memory in your interface and are having bit dropouts.

Second is the Level-II cassette-recorder modification, which is an added PC board that eliminates CLOAD problems due to the recorder's volume-control sensitivity. These are also described as being free in the May 1979 **Radio Shack Microcomputer Newsletter.**

Letters have been received from a few readers who say they've had to pay for these modifications, or who have been told there would be a charge.

According to Paul Huff, Radio Shack's director of computer services, these modifications are **free**, for both parts **and** labor. Anybody who has been charged, or who has been quoted a charge, should call the free Computer Services hotline number, 800-433-1679, and report it. Radio Shack will get in touch with the store manager and arrange for a refund, or for the modification to be performed at no charge. □

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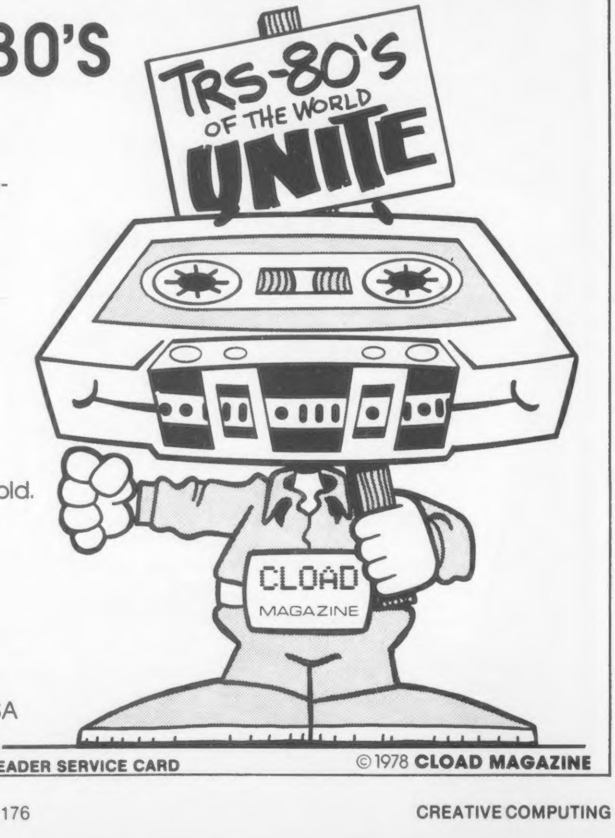

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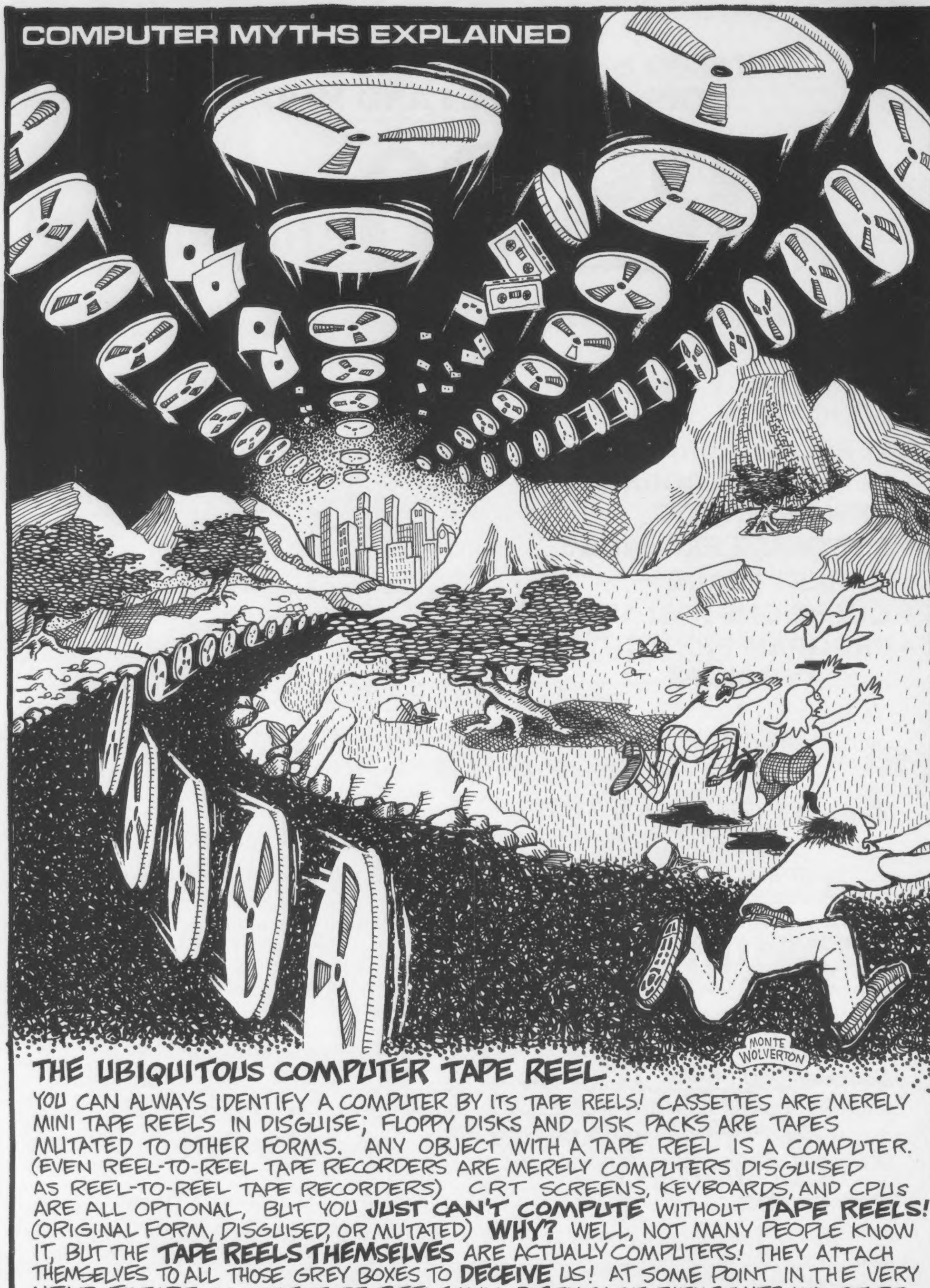

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| | |
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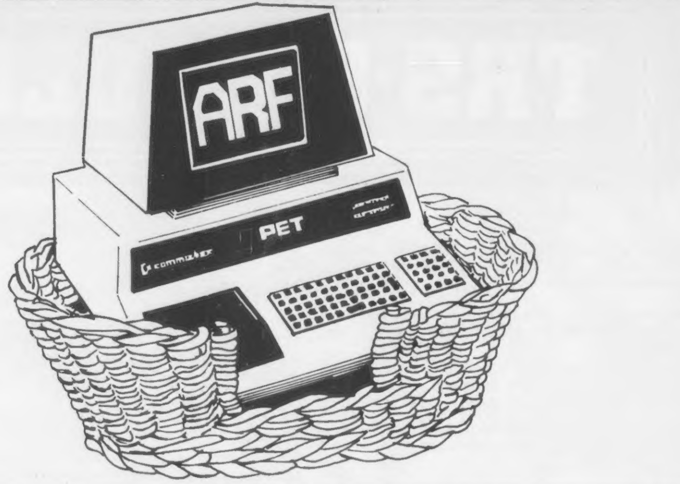
# Personal Electronic Transactions

### by Gregory Yob

I am happy to hear from you, and encourage your correspondence. I will try to acknowledge all correspondence, and a SASE makes things easier for both of us. Please send your letters to "Personal Electronic Transactions" c/o PO Box 354, Palo Alto, CA 94301.



## Ah, The New Pet (or CBM)...

Some of you are new PET owners, have the new 16 or 32K machine with a "standard" keyboard and have discovered that many nifty PET games don't play right, or the instructions come out looking strange, or whatever. You might want to look at our competitor, Kilobaud, July 79 issue, page 6, PET-Pourri and page 72, "Teach an old PET new Tricks (or vice versa)" by Len Lindsay, for two articles that deal with this problem.

I was an employee at Commodore when some of the changes were decided upon - and most of them result in a better product. (If you aren't into the technical stuff, skip on to the next section.)

1. The Keyboard - with a few positional changes, the new PET keyboard is a typeable version of the old one. Since the keyboard takes the entire front of the PET, the tape unit port #1 has been moved to the back and the tape unit is separate from the PET. (Tape unit #2 is the old #1 connector inside the PET.)

2. BASIC - many of the software bugs have been fixed - this includes the infamous 256 limitation on arrays! Most of the other bugs were only apparent when the memory was nearly full and you won't notice much change. As a result, the location of ROM routines that some of you hackers use has been changed.

3. All those PEEKs and POKEs in lower memory are different. When Microsoft wrote the BASIC for the PET, their awareness of the importance of the base page in the 6502 was not fully developed. Many frequently used values were put in the 3rd page, and many rarely used values were in the base page. The rearrangement makes the PET run about 15% faster!

4. The character ROM is different. If you POKE into upper/lower case, the capitals and lowercase are reversed - an old program that said: "Hello There" will now print "hELLO tHERE." The reason is that the keyboard now uses shift for the UPPER case as a normal keyboard does, and the ROM was changed to reflect this.

As far as this column is concerned, I will give the new and old values for any special maneuvering I do with PEEK and POKE - but all the programs will use the old values, as that's what I use to make my examples with (PET number 180 in fact.)

For the column on Screen Gymnastics published a while ago, the PET input buffer has moved:

NEW PET INPUT BUFFER IS: 623 to 632
NEW PET INPUT BUFFER COUNTER: 158

A last change is that Commodore now calls their machine the CBM instead of the PET. (Commodore Business Machine, right? I give CBM the Golden Fleece award for unimaginative product naming!)

## More on The Structure of BASIC - Variables

The last time we took a look at how a BASIC program was put together. This time some exploration of how BASIC stores its program values, or variables, will be attempted. Take a firm grip on your keyboards, and here we go...

Figure 1 shows how a BASIC program is arranged in the PET's memory. Starting at location 1024, the BASIC program's text is saved. The simple variables are stored immediately after the program - things like A$, B, or C% go there.

THE PET'S MEMORY AS SEEN BY BASIC

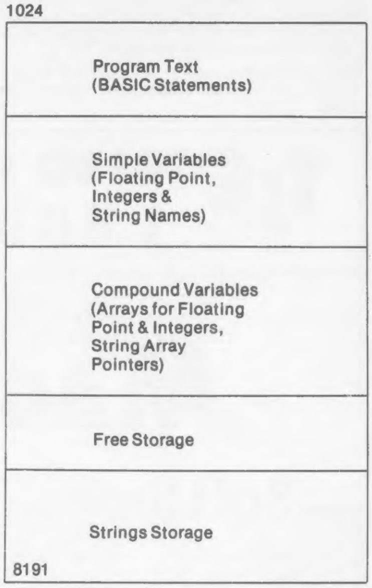

1024
Program Text (BASIC Statements)
Simple Variables (Floating Point, Integers & String Names)
Compound Variables (Arrays for Floating Point & Integers, String Array Pointers)
Free Storage
Strings Storage
8191

Figure 1

After the simple variables are the compound (or array) variables - A$(), B(), C%().

After the variables comes the empty space and the strings are stored at the top (we're going up in memory). (The simple variable S$ has two parts - the simple variable storage area points to the string which lives at the top of memory.) As variables and strings are created in the RUN of a BASIC program, they move towards each other - and if they meet, you see an ?OUT OF MEMORY ERROR.

When a BASIC program is RUN, the space above the program text is empty. As variables appear, they are

## PET, con't...

put into the simple or compound storage areas in the order of appearance (which might not be the order in the BASIC text due to GOTO or GOSUBs). If an array is declared and a new simple variable is needed, guess what? The entire arrays area is moved up a little bit in memory to make room for the new variable.

As strings appear, they are put in the top, moving downward. If the strings space hits the arrays space a "garbage collection" is performed to remove any discarded strings. (For example, A$ = "HELLO" and later, A$ = "THERE" will leave HELLO as discarded, and the garbage collection finds and removes this "garbage".)

When a program ends, all the variables are still left in place, which makes life simpler for us programmers. However, if you change the BASIC text, or even make the PET think you changed a line, there is the chance that the new text is larger than the old one and all the variables would have to be moved. The PET isn't that smart, and takes the simpler approach which is to remove all the variables.

(NOTE: The variables are still in the PET's memory, but the PET no longer knows how to find them. When I get to describing pointers, this will be covered in some more detail.)

**Looking at Simple Variables**

Figure 2 indicates the way the PET saves its simple variables. Each variable takes a block of 7 bytes, with the first two bytes storing the variable's name and type, and the remaining 5 bytes holding the variable's value (or a pointer in the case of strings). Let's use PEEK and see how these appear to us mortals.

Enter the following, exactly.

```
NEW
READY.
XX=0
READY.
FORJ=1024TO1040:?J;PEEK
(J)" lft sp sp sp sp": NEXT
  1024 0
  1025 0
  1026 0
  1027 36
  1028 88
  1029 88
  1030 0
  1031 0
  1032 0
  1033 0
  1034 0
  1035 74
  1036 0
  1037 139
  1038 1
  1039 224
  1040 0
READY.
```

Let's decipher all this. First, there isn't a BASIC program in the PET, so the bytes 1024 - 1026 indicate the end of a BASIC program. These are zeroes, as a zero linkage value is used for "end of program."

The 36 in location 1027 might be different on your PET. I haven't checked it out, but I suspect it is "memory trash." As an advanced exercise, enter a line or two of BASIC, do a CLR, XX = 0, and see what's after the ending 000 marker.

Locations 1028 and 1029 hold a pair of 88's - and CHR$(88) is "X." Since this is a floating point variable, the variable's name is easy to see.

If you home the cursor, and change the assignments to XX, the storage scheme for PET floating point numbers can be figured out. First, byte 1030 holds the binary exponent with the value .5 giving 128, 1 gives 129, and so on. Here are some examples:

| | Byte | | | | |
|---|---|---|---|---|---|
| XX = | 1030 | 1031 | 1032 | 1033 | 1034 |
| 1 | 129 | 0 | 0 | 0 | 0 |
| 2 | 130 | 0 | 0 | 0 | 0 |
| 4 | 131 | 0 | 0 | 0 | 0 |
| 65536 | 145 | 0 | 0 | 0 | 0 |
| .25 | 127 | 0 | 0 | 0 | 0 |

The number stored in bytes 1031-1034 is multiplied by 2 raised to the power of the number in byte 1030 (less 128).

The sign of the number is stored as the most significant bit in the first mantissa byte (in this case, byte 1031). Some examples:

| | Byte | | | | |
|---|---|---|---|---|---|
| XX = | 1030 | 1031 | 1032 | 1033 | 1034 |
| -1 | 129 | 128 | 0 | 0 | 0 |
| -1024 | 139 | 128 | 0 | 0 | 0 |
| 1024 | 139 | 0 | 0 | 0 | 0 |

OK, we know about the magnitude and the sign of our variable, XX. Figuring out the mantissa is more complicated. The key is in an idea called "normalization." For example, suppose you had the fraction (in binary) of .00110011 and we shift everything left by 3 places. The result would be 1.10011 multiplied by 2-3. Now, if every number were changed in this way, to always look like 1.******* multiplied by 2!!!!, there are two things to notice. First, this is just like our binary floating point - just add or subtract to the exponent byte. Second, there is always the 1. in every number, so why not write the number crunchers to assume this part is here and not store it in the memory. Another gain is that every number is now set up to its maximum precision and multiplications and divisions won't wreck the accuracy of a computation.

Here are some examples to sort out this mess, let's look at the value 32767:

| | Byte | | | | |
|---|---|---|---|---|---|
| XX = | 1030 | 1031 | 1032 | 1033 | 1034 |
| 32767 | 143 | 127 | 254 | 0 | 0 |

If this is expanded into binary digits, we see:

| 143 | 127 | 254 | 0 |
|---|---|---|---|
| 01001111 | 01111111 | 11111110 | 00000000 |

The leading zero in byte 1031 (127) is the sign of 32767, which is positive. The underlined 1's hold the value of 32767 x 2-14. Remember that this is really 1.11111111111111 with the 1. part missing.

I will leave it to you to decipher more complicated numbers (e.g., 123.456). It's too much for me! Some fun can be had by POKEing at our number, which will make new numbers. First, try making the largest possible number a PET can hold:

```
POKE 1030,255
POKE 1031,127
FORJ = 1032 TO 1034: POKEJ,
 255: NEXT
```

STORAGE OF SIMPLE VARIABLES IN THE PET

| | Integer | Floating Point | String |
|---|---|---|---|
| Byte 1 | First Character + 128 | First Character | First Character |
| Byte 2 | Second Character + 128 or 128 | Second Character or 0 | Second Character + 128 or 128 |
| Byte 3 | High Byte, 2's Complement | Binary Exponent + 128 or 0 | Number of Characters |
| Byte 4 | Low Byte, 2's Complement | Signed Binary Mantissa, MSB | Lo Pointer Byte |
| Byte 5 | 0 | Mantissa | Hi Pointer Byte |
| Byte 6 | 0 | Mantissa | 0 |
| Byte 7 | 0 | Mantissa, LSB | 0 |

Figure 2

## PET, con't...

and now:

```
1.70141183E+38
```

The smallest? Easy. POKE 1030,1

```
PRINT XX
```

(Do it yourself and see. Also try POKE 1030,255:POKE 1031,255.) Actually, the smallest in magnitude number requires that the mantissa be .....0000001. I am sure you can work this one out too.

Integer variables are simpler - they are just 16 bit values in 2's complement. I don't feel it's necessary to explain 2's complement in this column as the subject is covered in many computer texts. If you try XX%=0 and do the FOR-NEXT loop again, note that the variable name XX is now seen as 216 (216 = 128 + 88). Only locations 1030 and 1031 will change as you fiddle with XX%'s value. (Challenge: There is one value for XX% that can be POKEd into place, but you can't set up with XX% = (value). What is it?)

Another thing, did you notice that location 1035 is 74 and that CHR$(74) happens to be J, and why is that?

Getting at strings is a little different. Byte 3 holds the size of the string, and the next two bytes point to where the string starts in the PET memory. Away we go:

```
CLR
XX$="EUREKA! I FOUND IT, I THINK!"
FORJ=1030 TO 1032: PRINT PEEK(J) : NEXT
28
228
31
```

(If you have expansion memory, these two numbers will differ.)

Byte 1030 holds 28, the number of letters and spaces in the string XX$. The next two values indicate where in memory the string starts.

```
PRINT 31*256 + 228
8164
```

The second of the two bytes is the most significant and must be multiplied by 256. Now we can extract the string from the PET.

```
FORJ=8164 TO 8164+28-1:
PRINT CHR$(PEEK(J)); :NEXT
EUREKA! I FOUND IT, I THINK!
```

When the PET sees a string in the BASIC program text, like 10X$="THIS IS A CRUMMY EXAMPLE", there is no need to copy the string to another place in memory since the string's pointer can point to any place in memory. So, why not into the program text? This habit is also true of strings stashed in DATA statements. This means your PET tries to save on string space by avoiding unnecessary string copying.

Here are some things to try with the string variables and POKEs:

1. POKE a string into 255 characters, length, and make the pointer look into the PET's ROM (which is a sneaky way to PEEK into the ROM of your PET).

2. POKE a string into the screen memory. The start of the screen will be the pointer 0,128. A set of four properly POKEd strings would hold the entire screen, and think of the fun - as the screen changes, these string's contents would also change automatically, without any PEEKs or POKEs. This is a way to make a nifty "auto-input" routine by designating a part of the screen as an "input window."

### On To Array Variables

The storage of arrays is more complex than simple variables, as Figure 3 indicates. The first two bytes are the variable's name in the same format that simple variables use. The next two bytes indicate the total storage used by the array - that is, the space used by the variable name, array dimensions and values or pointers for each array element. Following the size are entries for the number of dimensions and the size of each dimension. After all this preamble, the values themselves are stored. Each value is the same format as simple variables; that is, a 5 byte floating point value for floating point, two byte integers, or string sizes and pointers.

| | |
|---|---|
| Byte 1 | Name & Type (Same as with Simple Variables) |
| Byte 2 | |
| Byte 3 | Total # of Bytes used by Array (Lo, High) |
| Byte 4 | |
| Byte 5 | Number of Dimensions n |
| Byte 6 | Size of Rightmost Dimension (High, Lo) |
| Byte 7 | |
| ...... | ..... |
| ...... | ..... |
| Byte 2n + 4 | Size of Leftmost Dimension (High, Lo) |
| Byte 2n + 5 | |
| Byte 2n + 6 | Start of Data Storage |
| | 2 Bytes for each Integer<br>3 Bytes for each String<br>5 Bytes for each Floating Point |

Figure 3

Figure 4 indicates the order of elements for an example array to assist you if you want to explore arrays with PEEK and POKE. I leave this to you to do, it is too tedious to show in this column. Remember that arrays are moved each time a simple variable is allocated, so allocate your simple variables first i.e., J=0:DIM X(20). Remember that the arrays will start after the simple variables.

```
EXAMPLE OF AN ARRAY'S ORDER
OF STORAGE
ARRAY CREATED BY DIM X(2,3,4)

X(0,0,0)     begin
X(1,0,0)
X(2,0,0)

X(0,1,0)
X(1,1,0)
X(½,1,0)

X(0,2,0)
X(1,2,0)
X(2,2,0)

X(0,3,0)
X(1,3,0)
X(2,3,0)

X(0,0,1)
X(1,0,1)
X(2,0,1)

etc

X(0,3,4)
X(1,3,4)
X(2,3,4)     end
```

Figure 4

### Where It Is All At - PET BASIC Pointers

When the PET runs a program, it does not search through the simple variables to find an array, or look through the BASIC program to find where the variables start. Deep in lower memory are some pointers which tell where each area begins and ends. Figure 5 shows these pointers for the old and new versions of the PET.

Once the PET is started up (or reset), the values of these pointers are only changed as necessary. This means that the pointers to the top and bottom of memory can be changed by POKEs, and the PET will think that its memory is different. For example, if the start of BASIC were moved up to 2048 (and all the other pointers that start at the bottom of memory), the "safe area" for machine language is now extended by 1024 bytes. Here is some fiddling with the pointers as an example (remember that I have an old 8K PET):

THE BASIC POINTERS FOR A PET

| OLD PET | | NEW PET | | WHAT IT IS |
|---|---|---|---|---|
| Low | High | Low | High | |
| 122 | 123 | 40 | 41 | Start of BASIC text. |
| 124 | 125 | 42 | 43 | Start of Simple Variables. |
| 126 | 127 | 44 | 45 | Start of Arrays |
| 128 | 129 | 46 | 47 | Start of Free Space |
| 130 | 131 | 48 | 49 | Bottom of Strings |
| 132 | 133 | 50 | 51 | Top of Strings |
| 134 | 135 | 52 | 53 | Top of BASIC memory |
| 146 | 147 | 64 | 65 | DATA statement pointer |

The value in a pointer can be obtained by multiplying the high value by 256 and adding to the low value. For example, the Bottom of String value is:
PEEK(130) + 256*PEEK(131)

Figure 5

```
(reset your PET)
?PEEK(134),PEEK(135)
0      32
```

The "top of memory" is at 8192 or one byte beyond the real top of memory which is 8191. All the pointers can be regarded as pointing to the start of their area. For the top of memory, this start is just beyond the end of memory "top of memory" = start of "beyond all memory," right?

```
?FRE(0)
7164
```

We have an 8K PET less a few bytes needed to evaluate the FRE function.

```
POKE 135,28
?FRE(0)
6140
```

The "top of memory" pointer has been moved down by 1024 bytes and now you have a "7K" PET, with a hole in the top, into which machine language or whatever can be put. As long as you don't reset your PET the top 1K won't be disturbed by BASIC (except by POKE).

Several BASIC commands really work by changing the BASIC pointer values. Here is a summary

| | |
|---|---|
| CLR | Sets DATA pointer to start of text -1 (That's why the 0 at 1024.<br>Top and Bottom of Strings become set to Top of Memory. Start of Arrays set to Start of Simple Variables. Start of Free Space set to Start of Simple Variables. |
| RUN | Performs same as CLR and then starts program. |
| NEW | Start of Simple Variables set to Start of Text + 3, Then perform CLR. |
| LOAD | If executed in a program, load the new program from tape into the text area. If the new program extends beyond the Start of Variables, perform a CLR when finished with the load. |
| Editing | Do the editing, change Start of Variables. Do a CLR. |

Well, there's the anatomy of PET BASIC. If you combine this knowledge with screen gymnastics, a variety of things can be done. I will indicate some things to try:

1. Reset the PET, LOAD a program. POKE the Start of Text pointer to the byte before the end link value. (That's the first zero in the 000 at a program's end.) Now LOAD another program. POKE all the Start of Text pointers back to their original values. LIST your program, and APPEND has been done. (Warning - I haven't done this one, so it might not work.)
2. RUN a program. STOP it, look at all the variable pointers. Do some editing that does not make the program text longer. Change the pointers back to their original values. See if the program's variables are now "restored."
3. Here is a handy function. Why?
   DEF FNF (X)=PEEK(X)+256*(PEEK(X+1))

## More on Cryptograms

Last year, someone (I don't recall who - or he would get a credit here) showed me a nifty trick for using the PET for cryptograms. Since I spent a lot of time in the last column on cryptograms, only the idea will be demonstrated here. It will take some effort to turn this notion into a usable cryptogram system.

The notion is to set the PET random number generator to a seed (in this case a key) value. Once the RND is set, the sequence after that will be the same - if the seed is the same. So, ask for a numerical key, set RND by X=RND(- key), and use the resulting random sequence for coding and decoding of the message.

Here is a short demo program - I invite someone to clean it up and to submit it to Creative Computing Software!

CYPHER PROGRAM

```
10 REM CYPHER 3 BY GREGORY YOB
20 REM CYPHER ALPHABET
30 A$=" sp ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789"
40 PRINT"clr CYPHERS"
50 INPUT"KEYNUMBER:";K
60 INPUT"ENCODE OR DECODE E/D";B$
70 IF B$="D" OR B$="E" THEN 90
80 GOTO 60
90 DIM M$(20),C$(20)
100 REM SET KEY
110 X=RND(-ABS(K))
120 REM ENTER MESSAGE OR CODE
130 PRINT"clr ENTER CHARACTERS. 'EXIT' TO QUIT
140 FOR J=1 TO 20
150 INPUT M$(J)
160 IF M$(J)="EXIT" THEN 190
170 NEXT J
180 REM CODE/DECODE
190 J=J-1
200 FOR K=1 TO J
205 X$=M$(K)
210 IF B$="E" THEN GOSUB 1000
220 IF B$="D" THEN GOSUB 2000
230 C$(K)=Y$
240 NEXT K
250 PRINT"clr NEW MESSAGE IS:"
260 FOR K=1 TO J
270 PRINT C$(K)
280 NEXT K
290 PRINT"dn dn PRESS ANY KEY"
300 GET X$:IFX$="" THEN 300
310 GOTO 130

1000 REM ENCODING
1010 Y$=""
1020 REM LOOK FOR CHAR, SP IF NOT FOUND
1030 FOR Y=1 TO LEN(X$)
1040 C$=MID$(X$,Y,1)
1050 FOR Z=1 TO LEN(A$)
1060 IF MID$(A$,Z,1)=C$ THEN 1080
1070 NEXT Z: Z=1
1080 D=INT(RND(1)*LEN(A$))+Z
1090 IF D>LEN(A$ THEN D+D-LEN(A$)
1100 Y$=Y$+MID$(A$,D,1)
1110 NEXT Y
1120 RETURN
```

Line 30 holds a string of the legal characters that can be encoded. If you tried the cryptography programs in the previous column, you surely noticed a lot of a&a*!%)#) stuff which is hard to copy, here only the alphabet and numbers are legal. You can change A$ to suit yourself.

The string arrays M$ and C$ hold the message - M$ holds what you enter first and C$ is the result after encode or decode. Line 110 sets the RND function to reflect the key and ABS lets you enter negative numbers for keys. One bit of advice: don't use integers, zero or numbers less than one for best random results.

Routines 1000 and 2000 handle the code/decode part, after the array M$ is processed into C$ the results are printed and more data can be entered.

Routine 1000 converts the string X$ into the encoded string Y$. First, a character is taken from Y$ (Lines 1030 and 1040). Then the character is matched in A$. If it isn't found it is set to space (space is the first character in A$). This is done in Lines 1050 and 1070.

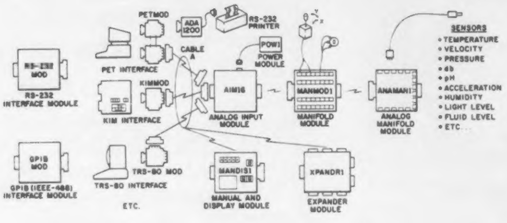
Lines 1080 to 1100 encode the character and add it to Y$. Note that line 1090 makes sure that the new character will be in A$. (D points to the encoded character, and if D is too large, the length of A$ is subtracted).

Routine 2000 is very similar - in 1000 the offset is added to the character number Z, and in 2000 it is subtracted.

This program can be cleaned up in many ways to work better and faster. As I said before, try making it into a saleable program. (If you do, send me a free tape, OK? Thanks.) ☐

## Data Acquisition Modules

DAM SYSTEMS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ADA 1200
RS-232 PRINTER
RS-232 MOD
RS-232 INTERFACE MODULE
PET INTERFACE
CABLE A
POW1
POWER MODULE
KIMMOD
KIM INTERFACE
AIM16
ANALOG INPUT MODULE
MANMOD1
MANIFOLD MODULE
ANAMANI1
ANALOG MANIFOLD MODULE
SENSORS
• TEMPERATURE
• VELOCITY
• PRESSURE
• db
• pH
• ACCELERATION
• HUMIDITY
• LIGHT LEVEL
• FLUID LEVEL
• ETC...
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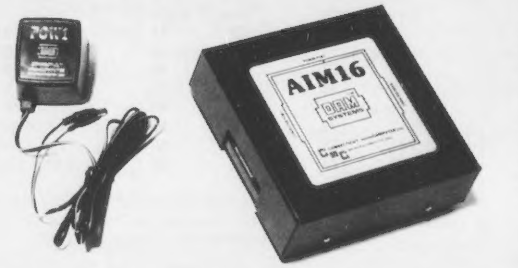
GPIB (IEEE-488) INTERFACE MODULE
TRS-80 MOD
TRS-80 INTERFACE
ETC.
MANDIS1
MANUAL AND DISPLAY MODULE
XPANDR1
EXPANDER MODULE

The world we live in is full of variables we want to measure. These include weight, temperature, pressure, humidity, speed and fluid level. These variables are continuous and their values may be represented by a voltage. This voltage is the analog of the physical variable. A device which converts a physical, mechanical or chemical quantity to a voltage is called a sensor.

Computers do not understand voltages: They understand bits. Bits are digital signals. A device which converts voltages to bits is an analog-to-digital converter. Our AIM16 (Analog Input Module) is a 16 input analog-to-digital converter.

The goal of Connecticut microComputer in designing the DAM SYSTEMS is to produce easy to use, low cost data acquisition modules for small computers. As the line grows we will add control modules to the system. These acquisition and control modules will include digital input sensing (e.g. switches), analog input sensing (e.g. temperature, humidity), digital output control (e.g. lamps, motors, alarms), and analog output control (e.g. X-Y plotters, or oscilloscopes).

## Analog Input Module


POW1
AIM16
DAM SYSTEMS

The AIM16 is a 16 channel analog to digital converter designed to work with most microcomputers. The AIM16 is connected to the host computer through the computer's 8 bit input port and 8 bit output port, or through one of the DAM SYSTEMS special interfaces.

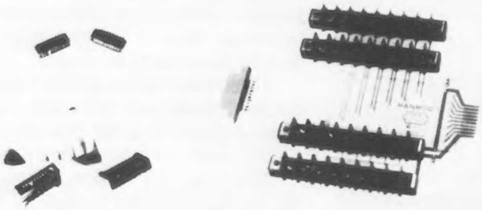
The input voltage range is 0 to 5.12 volts. The input voltage is converted to a count between 0 and 255 (00 and FF hex). Resolution is 20 millivolts per count. Accuracy is 0.5% ± 1 bit. Conversion time is less than 100 microseconds per channel. All 16 channels can be scanned in less than 1.5 milliseconds.

Power requirements are 12 volts DC at 60 ma.

The POW1 is the power module for the AIM16. One POW1 supplies enough power for one AIM16, one MANMOD1, sixteen sensors, one XPANDR1 and one computer interface. The POW1 comes in an American version (POW1a) for 110 VAC and in a European version (POW1e) for 230 VAC.

| | |
|---|---|
| **AIM16 . . .** | **$179.00** |
| **POW1a . . .** | **$ 14.95** |
| **POW1e . . .** | **$ 24.95** |

## Connectors



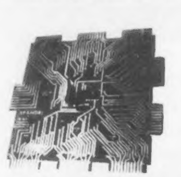
The AIM16 requires connections to its input port (analog inputs) and its output port (computer interface). The ICON (Input CONnector) is a 20 pin, solder eyelet, edge connector for connecting inputs to each of the AIM16's 16 channels. The OCON (Output CONnector) is a 20 pin, solder eyelet edge connector for connecting the computer's input and output ports to the AIM16.

The MANMOD1 (MANifold MODule) replaces the ICON. It has screw terminals and barrier strips for all 16 inputs for connecting pots, joysticks, voltage sources, etc.

CABLE A24 (24 inch interconnect cable has an interface connector on one end and an OCON equivalent on the other. This cable provides connections between the DAM SYSTEMS computer interfaces and the AIM16 or XPANDR1 and between the XPANDR1 and up to eight AIM16s.

| | |
|---|---|
| **ICON . . .** | **$ 9.95** |
| **OCON . . .** | **$ 9.95** |
| **MANMOD1 . . .** | **$59.95** |
| **CABLE A24 . . .** | **$19.95** |

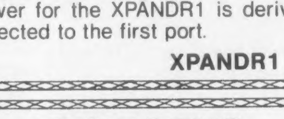
## XPANDR1



The XPANDR1 allows up to eight AIM16 modules to be connected to a computer at one time. The XPANDR1 is connected to the computer in place of the AIM16. Up to eight AIM16 modules are then connected to each of the eight ports provided using a CABLE A24 for each module. Power for the XPANDR1 is derived from the AIM16 connected to the first port.

| | |
|---|---|
| **XPANDR1 . . .** | **$59.95** |

## TEMPSENS



This module provides two temperature probes for use by the AIM16. This module should be used with the MANMOD1 for ease of hookup. The MANMOD1 will support up to 16 probes (eight TEMPSENS modules).

Resolution for each probe is 1°F.

| | |
|---|---|
| **TEMPSENS2P1 (-10°F to 120°F) . . .** | **$49.95** |

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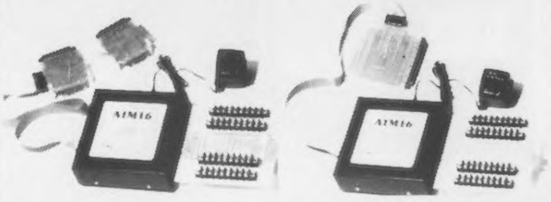
# Computer Interfaces and Sets



For your convenience the AIM16 comes as part of a number of sets. The minimum configuration for a usable system is the AIM16 Starter Set 1. This set includes one AIM16, one POW1, one ICON and one OCON. The AIM16 Starter Set 2 includes a MANMOD1 in place of the ICON. Both of these sets require that you have a hardware knowledge of your computer and of computer interfacing.

For simple plug compatible systems we also offer computer interfaces and sets for several home computers.

The PETMOD plugs into the back of the Commodore PET computer and provides two PET IEEE ports, one user port and one DAM SYSTEMS port. The PETMOD is connected to the AIM16 or XPANDR1 with CABLE A24. The PETSET1 includes one PETMOD, one CABLE A24, one AIM16, one POW1 and one MANMOD1. To read and display a single AIM16 channel (N) using the PETSET1 the BASIC statements

```
POKE59426,N:POKE59426,255:X=PEEK(59471):PRINT"CHANNEL "N"="X
```

are all that is needed.

The KIMMOD plugs into the COMMODORE KIM applications connector and provides one application connector and one DAM SYSTEM'S port. The KIMMOD is connected to the AIM16 or XPANDR1 with CABLE A24. Assembly and machine language programs for reading and displaying data are included. The KIMSET1 includes one KIMMOD, one CABLE A24, one AIM16, one POW1 and one MANMOD 1.

All sets come in American and European versions.

| | |
|---|---|
| **AIM16 Starter Set 1a (110 VAC)** | **$189.00** |
| **AIM16 Starter Set 1e (230 VAC)** | **$199.00** |
| **AIM16 Starter Set 2a (110 VAC)** | **$259.00** |
| **AIM16 Starter Set 2e (230 VAC)** | **$269.00** |
| **PETMOD** | **$ 49.95** |
| **KIMMOD** | **$ 39.95** |
| **PETSET 1a** | **$295.00** |
| **PETSET1e** | **$305.00** |
| **KIMSET1a** | **$285.00** |
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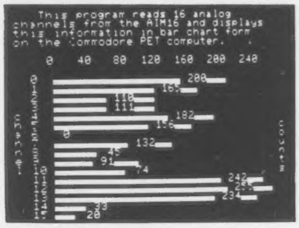
Our standard warranty for all our products is 90 days.



This program reads 16 analog channels from the AIM16 and displays this information in bar chart form on the Commodore PET computer.

## Order Form

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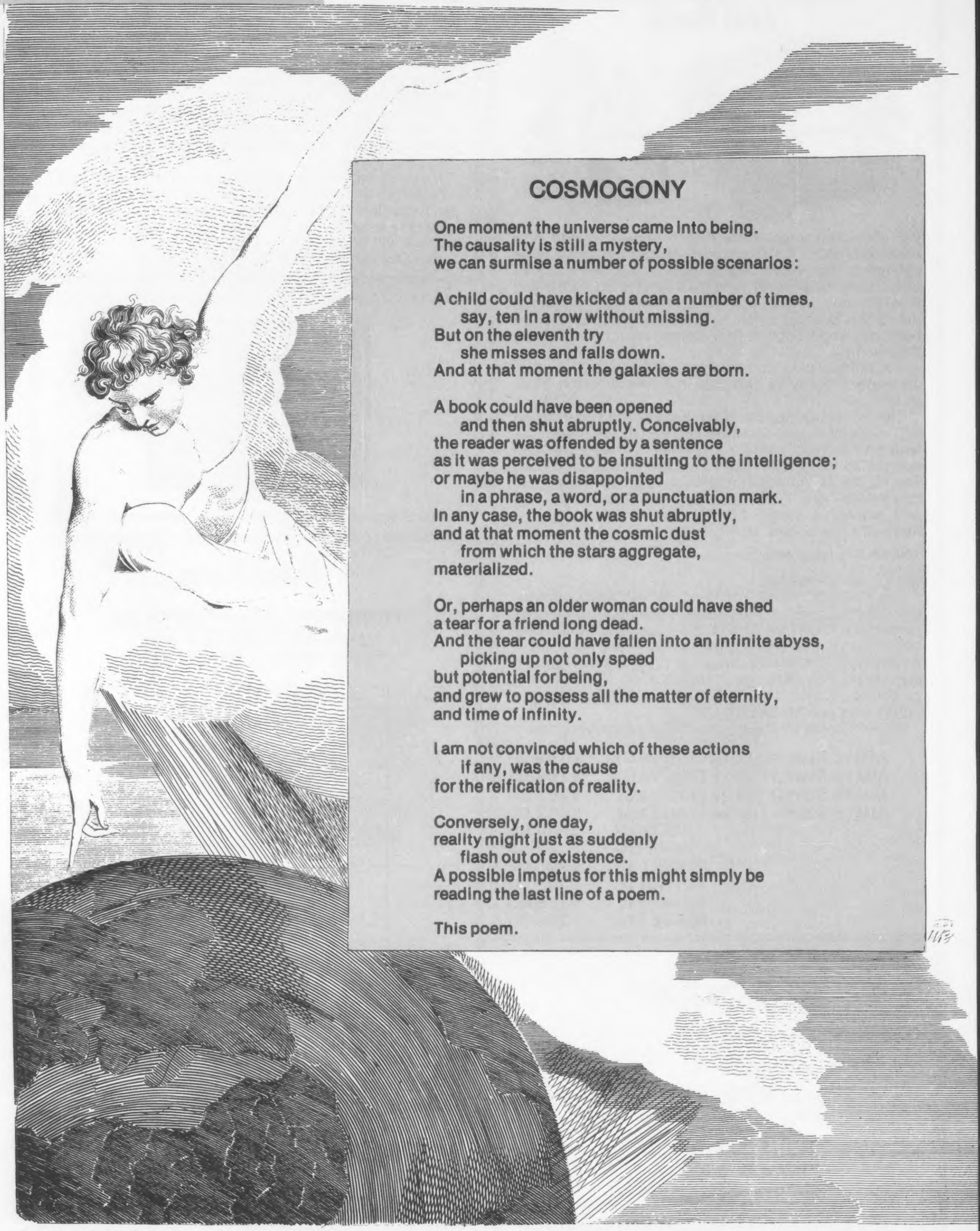

# COSMOGONY

One moment the universe came into being.
The causality is still a mystery,
we can surmise a number of possible scenarios:

A child could have kicked a can a number of times,
say, ten in a row without missing.
But on the eleventh try
she misses and falls down.
And at that moment the galaxies are born.

A book could have been opened
and then shut abruptly. Conceivably,
the reader was offended by a sentence
as it was perceived to be insulting to the intelligence;
or maybe he was disappointed
in a phrase, a word, or a punctuation mark.
In any case, the book was shut abruptly,
and at that moment the cosmic dust
from which the stars aggregate,
materialized.

Or, perhaps an older woman could have shed
a tear for a friend long dead.
And the tear could have fallen into an infinite abyss,
picking up not only speed
but potential for being,
and grew to possess all the matter of eternity,
and time of infinity.

I am not convinced which of these actions
if any, was the cause
for the reification of reality.

Conversely, one day,
reality might just as suddenly
flash out of existence.
A possible impetus for this might simply be
reading the last line of a poem.

This poem.

Peter Payack, 64 Highland Ave., Cambridge, MA 02139.

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Added features for the 16/32K version include string search for editing, keyboard entry during printing for letter salutations, justification, multiple printing and more.

A thirty page instruction manual is included.

The CmC Word Processor Program for the 8K PET is $29.50. The 16/32K version is $39.50.

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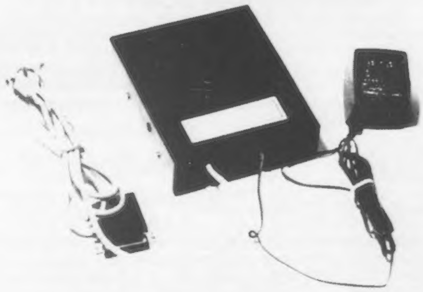

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A cassette tape is included with software for plots, formatting tables and screen dumps. The ADA1200 sells for $169.00 and includes case, power supply and cable.

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# Reviews

### Stephen B. Gray

**How to Build a Computer-Controlled Robot,** by Tod Loofbourrow. Hayden Book Company, Inc., Rochelle Park, NJ. 139 pages, paperback $7.95. 1978.

As the back cover phrases it, "This book details the step-by-step directions for building a computer-controlled robot, named Mike, controlled by a KIM-1 microprocessor."

Each chapter opens with a complete and detailed parts list for building what is described in that chapter. Building the basic framework (chapter two) is the hardest task, since it involves a triangular frame with motor-driven wheels, which means a lot of metalworking.

After that, it's mainly building circuits on perf board. The software starts on page 37, with flowcharts and a machine-language program that monitors the joystick, used to operate Mike manually from a control box.

By page 49, the book gets into the software that permits Mike to operate independently, and before long impact sensors are added to give Mike a sense of touch, then ultrasonics so Mike can "see," and finally voice recognition (the most complex chapter) involving eight commands.

The author, who from the photograph may still be in his teens, has taken a great deal of care to provide a detailed text, exact specs for parts, complete flowcharts and programs, and full schematics. Even if you never build Mike, you can learn a great deal about computer control from this fascinating book, which may well be the most complete text yet written on a computer-related construction project for the hobbyist.

* * *

**BASIC for beginners,** by Brian M.J. Kavanagh. Holmes McDougall Ltd., Allander House, 137-141 Leith Walk, Edinburgh EH6 8NS, Scotland. 128 pages, paperback 2.95. 1978.

Another in the Computer Studies Series from Holmes McDougall, this is in the same style and design as the previous language books on FORTRAN, ALGOL and COBOL.

Written for college students, the book assumes no previous knowledge of computing, and starts with an introduction that shows how to use a computer terminal and paper-tape input.

The second chapter starts off slow and easy with BASIC, with a simple three-line program without line numbers, one of the very, very few BASIC books to do so. After only half a page, several assignments are given. Assignments are sprinkled about in each chapter, with several problems each; solutions to most of them are in the back of the book.

The chapter includes more practical information on using a computer terminal, on batch BASIC, and shows how to use mark-sense BASIC cards.

Subsequent chapters take the reader, carefully and thoroughly, through the basics of BASIC, in chapters on input and output, arithmetic, decision-making, functions, characters and strings, FOR loops, arrays, sorting, subroutines, and matrix operations.

The programs are all short and simple, and flowcharts are used extensively. The writing is clear and concise, and covers many of the small points.

The text occupies the inside half of each page; the outside half is used for illustrations, either flowcharts or printouts. For some reason the printouts are overprinted with a blue that's just a little too dark for easy reading of some of the LISTs and RUNs, but that's a small drawback in a text that's one of the better books on BASIC. Although a total of 24 pages is taken up with that outer-half white space....

**The Secret Guide to Computers,** by Russ Walter. Published by Russ Walter, 92 St. Botolph St., Boston, MA. 02166. Part 1: BASIC, $2.75. Part 2: Applications, $2.50. Part 3: Languages, $3.50. Part 4: Systems, $2.75. Vol. C1: Hassles in BASIC, $2.50. Vol. C2: Answers to Tough Questions, $2.25. (All six volumes, $16.25). All paperback. Various publication dates, depending upon edition.

**Part 1: BASIC.** Don't let page ii throw you off, even though it says "This book is written for idiots," tells you the author got his math degree from Dartmouth "in yummy '69," and says about his course on How to Become a Computer Expert in Six Weeks, that "His wife does a strip tease in front of the students, to teach them a thing or two about computer anatomy."

This book is intended for use at a timesharing terminal, and starts with a couple of pages on how to use the terminal, in the chapter on "Chat With Your Computer," which also presents several very short programs, how to make basic calculations and how to use line numbers to edit are shown. "Making The Computer Think" covers variables, computer notation, INPUT, ending a program, IN/THEN and disks. "Ease The Strain" looks at FOR/NEXT, printing formats, and debugging. The third chapter, "Meaty Programs," gets into READ/DATA, functions, loops, subscripts, GOSUB/RETURN, and REMARK.

The writing is straightforward, gets into the many little nooks and crannies that show the author has taught BASIC, and seems to be aimed at the fairly intelligent high-school freshman.

The text is entirely typewritten, including the programs, and all underlines and boxes are done by an uneven hand.

The last two chapters are on "Programming Is An Art" (full of pointers and helpful hints) and "Special Features" (fancy editing, peripherals).

In various places, different ways to perform a particular task on different computers are given, for machines such as CDC, H-P, Altair, DEC and Radio Shack computers. For instance, the section on GOSUB/RETURN contains a note, "Warning: on Radio Shack computers, omit the space between GO and SUB. Instead of GO SUB, say GOSUB."

The book would be much neater if the white space often found at the bottom of a page were used here and there to separate programs from text by a line or two.

Although occasionally flippant, Part 1 does cover a limited number of BASIC statements in detail, and most of the programs are short and simple. For $2.75, you won't go wrong.

**Part 2: Applications.** No, this isn't a book on how to use your computer or time-sharing system to do something other than just crunch numbers. Surprise! It tells you what other people have done, all of them using much more complex computers than most of us are ever liable to get our hands on. So this book is more of a collection of computer applications the author found of interest, rather than showing the reader something he'd probably be much more interested in: how to use his own computer.

Part 2 consists of four sections, on Words (translating Russian, programs for various facets of understanding English, creating poetry and prose, etc.), Shapes (computer art, all but one requiring a plotter or special printer or 3D graphics system), People (a hodge-podge of computer-related job descriptions, a logic game RUN, etc.) and Effects (another hodgepodge, including computer jargon, artificial intelligence, computers in the home, dangers of computers).

Part 2 could be helpful if you know absolutely nothing about computers and would like to have a highly eclectic collection of material on various aspects of the subject. But much of it is barely of passing interest, and it is getting quickly out of date.

**Part 3: Languages.** This is one of the few publications that discuss FORTRAN, COBOL and ALGOL in one book, as well as giving a little information about a dozen other languages, such as DYNAMO, LIPS, APL and SPSS.

Three major languages in the book are discussed in enough detail to give the reader a good idea of how they work. About 29 pages are devoted to FORTRAN, 24 to COBOL, and 8 to ALGOL; the other languages get a couple of pages each.

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If you're at all curious about languages other than BASIC, this is well worth the money, especially the couple of charts that show how several program lines are expressed in the different languages.

**Part 4: Systems.** This would seem to be a general text on computer hardware, but it gets much more into assembly language than most readers would probably care for, with page after page of mnemonics tables, for the PDP-10, IBM 360, CDC 6600, PDP-11, and also for the 6502, 6800 and 8080 MPUs.

Other publications do a better job of covering systems, but they cost much more than $2.75. For the money, this is pretty good.

This may well be the only book to recommend computers "for the average buyer." The recommendations include maxi computers (Burroughs B6700, IBM 360/370, PDP-20, CDC 6600, etc.), minis (PDP-11, DG Nova, IBM System/32), typical micros (IBM 5100, Apple II, Altair 8800B), and cheap micros (KIM-1, Radio Shack TRS-80). The accompanying text discusses the choices with helpful information about the best machine to use "if you want to write FORTRAN programs on cards," for COBOL, for RPG, etc.

The last four pages are ads for the author's summer computer course and for this set of books.

**Vol C1: Hassles in BASIC.** The preface says that C1 and C2 are called the Commentary, and "contain juicy tidbits that my editor wouldn't let me put into volumes 1-4, because he said these tidbits would muddle your little icky-poo brain. 'Some editor!' 'Hassles in BASIC' delves into the dung that poses problems for programmers. When you surface at the end of the volume, you'll be a smelly but smiling winner. Have fun."

Vol. C1 is meant to be a companion to Part 1 (called Volume 1 in later editions), and has an index showing which pages of C1 are meant to be studied along with (or after) certain pages of Part 1.

What C1 does is mainly provide extended footnotes, or show how an operation is performed on several different computers. For instance, you're shown how to log in on the PDP-10, PDP-11, PDP-20, CDC, Dartmouth and Altair computers. You learn in detail how the sequence of operations affects how expressions are evaluated. You learn how to copy a program disk and how to rename a saved disk program. You find out how to do "fancy printing" by using rounding, PRINT USING, etc. You're given several programs, on printing out a calendar, and converting units of time to other units (minutes to week, etc.). You get help to "master the tricky functions," including trig functions, logs, EXP, INT, SGN, etc. There are sections on Loop Techniques, Subscripts, files, and nested subroutines.

Although we haven't seen C2, it must be more of the same, and if anything like C1, can also be recommended for supplying extra information, especially at these prices.

All in all, despite a certain degree of childishness here and there, these six publications do seem worth the money. As for content, they don't stand up against various hard cover texts, but few if any of the hard cover books get into some of the areas covered here. They can be recommended for the beginner who wants a basic understanding. For further study, Part 4 contains a good list of books, three pages full, covering subject such as BASIC, programming style, assembly language, home computers, artificial intelligence, and the "good and evil effects" of computers, and a dozen others. A coding system indicates if the book is easy, medium-easy, medium, medium-hard or hard. The list starts with the $8.50 paperback by Kemeny and Kurtz on BASIC Programming, and ends with the $60 Petrocelli Encyclopedia of Computer Science. The first is described as "medium," the last as "medium-hard."

* * *

**Belais' Master Index to Computer Programs in BASIC,** by Paul T. Belais. Falcon Publishing, 140 Riverside Ave., Box 688, Ben Lomond, CA 95005. 192 pages, paperback, $9.95. 1979.

This is an annotated index to 531 BASIC programs published in personal computing magazines, including **Creative**

**Computing** (of course), **Byte, Interface Age, Kilobaud, Personal Computing** and others through December 1978. It covers six areas: business/finance, games, math, personal interest, science/education, and utilities. Each entry tells where to find the program, the author, length, version of BASIC, length in number of lines, and special requirements. Each entry also includes a moderately long (one paragraph) description of the software so you can get some idea of how useful a particular program will be. Updates and corrections are also listed — a valuable feature. Even if you already have a magazine index, you'll probably find this to be an especially worthwhile reference. So if ever you're wondering where to find any of 531 published programs, here's the answer. —SN

* * *

**The Network Nation: Human Communication via Computer** by Starr Roxanne Hiltz and Murray Turoff. Addison-Wesley Publishing Company, Reading, MA 01867. 528 pages, paperback $17.50, hardcover $29.50. 1978.

This highly readable and comprehensive work must be The Book on computer conferencing. Its authors are a sociologist and a computer scientist, who collectively have an ideal frame of reference for exploring this topic. In addition, both are also involved with an actual computer conferencing system, funded by the National Science Foundation and operated out of the New Jersey Institute of Technology.

**The Network Nation** is split into three parts. The first, "The Nature of Computerized Conferencing," contains background information and history on several different systems, and the interactions and structures that form in computer conferencing. The second section, "Potential Applications and Impacts of Computerized Conferencing," discusses potential impacts of computer conferencing on management and their organizations, the handicapped, and the public and scientific community. The final section, "Projecting the Future: The Technology and its Regulation," explores design problems and considerations for computer conferencing systems, technical requirements, economics, policy and more.

The style of the book is clear and forthright. It deals with concrete examples and ideas, not generalities. For classroom use, questions for discussion are included. There's even some humor, in the form of excerpts from the highly fictional Boswash Times of the future in which (among other things) we learn that a computer conferencing system is named in a divorce suit.

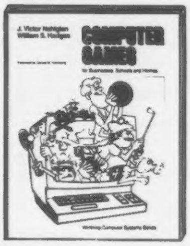
**The Network Nation** is well worth reading for its exposition of this leading edge topic, and also for some very useful insights into designing people-oriented systems. —SN

* * *

**Privacy: How To Protect What's Left Of It**, by Robert Ellis Smith. Anchor Press/Doubleday, Garden City, NY. 345 pages, hardcover, $10.00. 1979.

This is an exceptionally thought-provoking, fact-crammed, revealing and probably controversial book. People involved in computing may have a larger blind spot than others when it comes to abuse of computer based information (unless you've been classified as a poor credit risk because the TRW computer thinks you defaulted on car payments when you were 12 years old).

**Privacy** covers four particular aspects—informational, technological, physical and psychological privacy. It includes historical and technological background, scare stories (enough to keep you up for at least several nights) and, better yet, ways to cope without going on a crusade. However, it concludes on an upbeat note, pointing out that "privacy is not an end in itself, but the creation of an environment for creativity, thought, sharing, happiness, experimentation and growth." —SN



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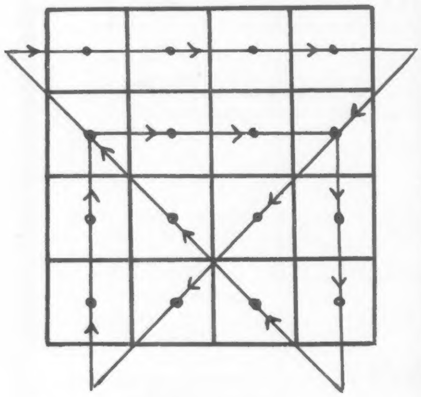
## Puzzle Answers.

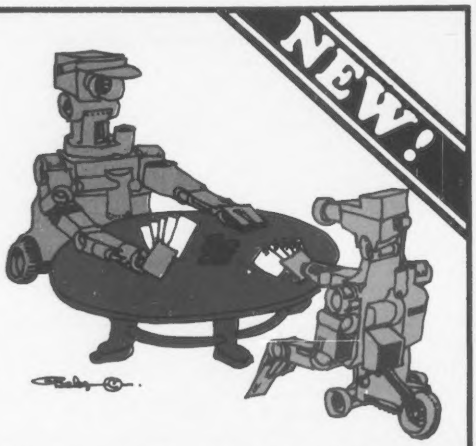
1. See diagram.



2. The day is Sunday.
3. There are thirty-four squares and 104 triangles.
4. The riddle is; "What is black and white and read all over"? The answer to the riddle is "a newspaper."
5. Nowhere—now here.

* * *

We didn't all come over on the same ship, but we're all in the same boat.



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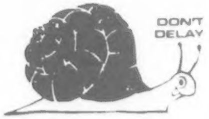

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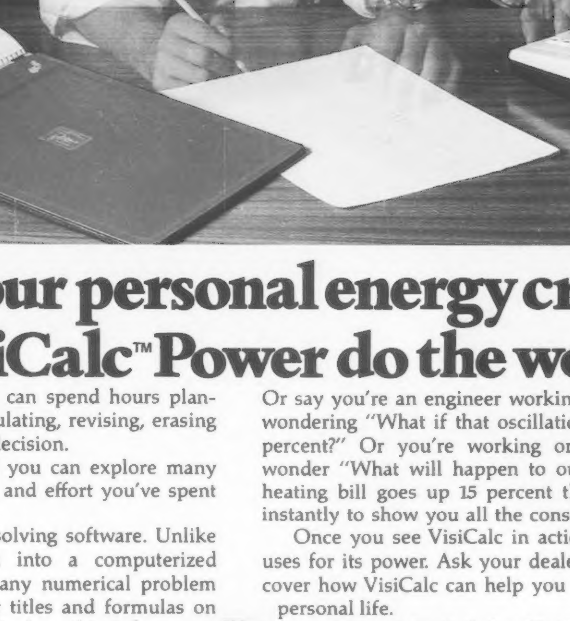

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"We can heartily recommend the Superboard II computer system for the beginner who wants to get into microcomputers with a minimum of cost. Moreover, this is a 'real' computer with full expandability."

*Popular Electronics March, 1979*

"(Their) new Challenger 1P weighs in at $349 and provides a remarkable amount of computing for this incredible price."

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"Over the past four years we have taken delivery on over 25 computer systems. Only two have worked totally glitch free and without adjustment as they came out of the carton: The Tektronic 4051 (at $7,000 the most expensive computer we tested) and the Ohio Scientific Superboard II (at $279 the least expensive) . . . The Superboard II and companion C1P deserve your serious consideration."

*Creative Computing January, 1979*

"The Superboard II and its fully dressed companion the Challenger 1P series incorporate all the fundamental necessities of a personal computer at a very attractive price. With the expansion capabilities provided, this series becomes a very formidable competitor in the home computer area."

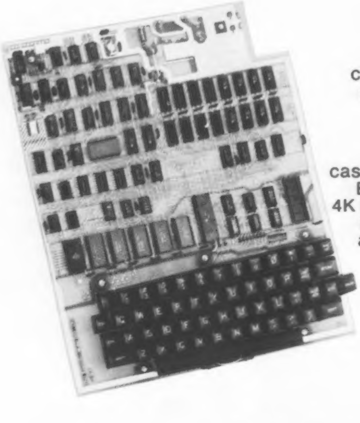
*Interface Age April, 1979*

"The graphics available permit some really dramatic effects and are relatively simple to program . . . The fact that the system can be easily expanded to include a floppy means that while you are starting out with a low-cost minimal system, you don't have to throw it away when you are ready to go on to more complex computer functions. Everything is there that you need; you simply build on to what you already have. You don't have to worry about trading off existing equipment to get the system that will really do what you want it to do. At $279, Superboard II is a tough act to follow."

*Radio Electronics June, 1979*

"The Superboard II is an excellent choice for the personal computer enthusiast on a budget."

*Byte May, 1979*



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CHALLENGER 1P

C1P $349.00
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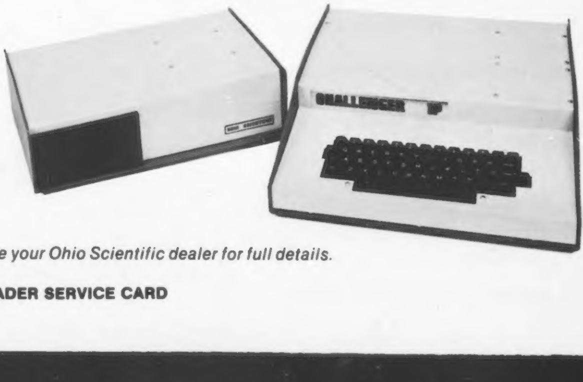

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